Proceedings of the

Sixth Conference on Maple Products

October 19-20, 1965

Philadelphia, Pa.

Agricultural Research Service
U. S. DEPARTMENT OF AGRICULTURE

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SIXTH CONFERENCE

ON MAPLE PRODUCTS

Held October 19-20, 1965

in Philadelphia, Pa.

at the

Eastern Utilization Research and Development Division

Agricultural Research Service

United States Department of Agriculture

PREFACE

The sixth conference on maple products held on October 19-20, 1965, at the Eastern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture, Philadelphia, Pa. 19118, was attended by representatives of the Governments of the United States and Canada, State governments; the State agricultural experiment stations; the extension services; universities, maple producers, processors, and distributors; and equipment manufacturers. Names and addresses of conferees are listed at the end of this report.

Laboratory exhibits were displayed on ultraviolet sterilization of sap, new instruments, continuous high flavoring of sirup, and large-scale extraction apparatus.

CONTENTS

[SUMMARY OF WELCOME ADDRESS BY P. A. WELLS]

Director P. A. Wells of the Eastern Utilization Research and Development Division welcomed the delegates to the Sixth (triennial) Maple Conference. He pointed out that the first Maple Conference was held here in November 1950 as our annual State Experiment Station Collaborators' Conference for that year. He also pointed out that maple conferences have been held here regularly every three years since that time. Some of the delegates who attended the 1950 meeting are here today and appear to be just as enthusiastic as they were at the first meeting.

The chief purpose of these meetings is the exchange of research information among Universities, State Experiment Stations, Industry, and State and Federal Government people. Another great value of these meetings is the opportunity they afford for contacts among the delegates and the exchange of individual views and experiences.

A conference report will be prepared and each delegate will automatically receive one copy. Additional copies will be supplied on request. A group photograph of the delegates will be taken and a print of the picture will be supplied each person attending the meeting, with a copy of the conference report.

[SUMMARY OF CONFERENCE THEME ADDRESS BY C. O. WILLITS]

Dr. C. O. Willits of the Eastern Utilization Research and Development Division in presenting the theme of the Conference stated that it would follow essentially the same pattern as that of the preceding ones. The program will cover topics on new developments dealing with all the different phases of the industry. New topics for this Conference will be reports on economic surveys, crop reporting, and a roundtable discussion on the fall tapping of maple trees. The presentations are supplemented by a display of reprints of current publications on subjects related to the maple industry. So that the conferees will be given a broader view of the maple situation as it exists in the different states, members of the Extension Service who chair the four different sessions will give a brief account of developments in their respective areas.

CHAIRMAN: James A. Bochy

INTRODUCTORY REMARKS ON PENNSYLVANIA MAPLE SIRUP

By James A. Bochy, Agricultural Agent, Somerset County, Pa.

In early 1957 the Somerset County Maple Syrup Producers' Association was reactivated. This followed several years of educational meetings sponsored by the local Agricultural Extension Service. This county group, the only maple organization in the State at the time, represented Pennsylvania on the National Maple Syrup Council when it was formed in 1959 at Philadelphia.

After several exploratory meetings at Penn State, spearheaded by Extension Forester Ed Farrand, a State Maple Syrup Council was organized in January 1964 at the State Farm Show. This young organization has already recorded some major achievements for the maple industry and its members:

... Petitioned and was accepted as an official agricultural organization by the State Farm Show Commission.

... Secured additional exhibit space at the State Farm Show making possible county or area competitive exhibits.

... Promoted an increase in premium money for maple exhibits at the State Farm Show.

... Accepted as a member of the Pennsylvania State University Agricultural Advisory Council.

... Supported a graduate study program of "Economics of the Central Evaporator."

... Supported legislation and action favorable to the maple industry.

... Working with the can industry for improvement in containers and group purchase of cans.

... Group marketing of bulk syrup.

... Cooperation with the State Bureau of Foods and chemistry in working out health standards.

... Several promotional plans have been initiated. An exhibit has been prepared for showing at the week-long 50th Anniversary Meeting of the National Association of County Agricultural Agents at the Hilton Hotel in Pittsburgh. This exhibit will be used at other locations following the Pittsburgh meeting .

. . . The group held its first State Maple Tour. This was hosted in Somerset County in early October with more than 100 persons participating. In addition to Pennsylvania the States represented included New York, West Virginia, Wisconsin, Maryland, and visitors from California and Florida.

. . . Cooperated in the survey of trees known as the "Sweet Tree Program."

Under State President Ed Curtis of Honesdale, the group is making some notable contributions to the State's sweetest industry.

SELECTION AND PROPAGATION OF SUPERIOR SUGAR MAPLE TREES

(Presented by Melvin R. Koelling)

By Melvin R. Koelling and William J. Gabriel, Northeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Burlington, Vt.

The Possibilities

One important factor in the future development of the maple sugaring industry is the contribution that improved trees, developed through selection and breeding, may make in reducing production costs. The reduced costs would be achieved through increased production of sugar per tree and per man-hour of labor.

Total sugar production may be increased in two ways: (1) by raising the sugar content in sap and (2) by increasing the total yield of sap. It would be desirable to simultaneously develop the traits of sweeter sap and greater sap volume, but at present we are unable to work on both. Our current plan is to work first on achieving high sugar content of sap. However, much of the knowledge of techniques and procedures gained in this phase of the program will have application to the sap-volume phase when it is undertaken.

Individual tree variation in the sugar content of sap has been observed by a number of people. Moore and coworkers in 1951 noted that variation in sugar content among trees was not related to differences in soil, site, or other natural factors. They suggested that this variation might be inherent.

Taylor in 1956 found consistent season-to-season performances by individual trees in total sugar production. When ranked according to sweetness, the same trees appeared in the same relative position year after year. This suggested that genetic factors were playing an important role in determining sugar content. Marvin (1957) and Kriebel (1963) also pointed out the possibility of sap sweetness being an inherited characteristic.

Our Tree-Selection Program

A program for selecting trees that are superior sugar producers was begun at the Northeastern Forest Experiment Station in Burlington in1962. For the first two years, the work was exploratory in nature and dealt primarily with techniques of sampling and selection. The procedure called for an initial sample of 10 trees in each sugar bush to establish a preliminary average. Then a sample of 100 trees was taken. If any tree in the 100-tree sample produced sap 50 percent sweeter than the average for the 10 tree sample, it was marked for future reference. In 1962 35 trees were selected on this basis. However, this procedure proved unsatisfactory because it did not provide means for evaluating differences in environment and differences in density, size, or age class within sugarbushes.

A new procedure was developed before the 1964 season. Called progressive sampling, this method utilizes only one sample, preferably of 100 trees, although the number is flexible. The fieldman begins a cruise line at a convenient location and records percentage sweetness for each tree he encounters. When he finds a tree with sap that is substantially sweeter than the sap in other trees along the line, he takes sugar readings from four or five immediately adjacent trees. These trees serve as standards. To be considered for selection, a tree must exceed the sweetest of the standards by at least one-half a percentage point in sap sugar, and relatively it must be at least 30 percent above the average of the standards.

Each selected tree and its surrounding standards are marked, and each such group of trees is tested twice more during that sugaring season and again twice in the following season. At the time of the last test a brief description of the soil and of the topographic situation is recorded. All within-group testing is completed as quickly as feasible so as to minimize confounding of possible genetic variation with the changes in sugar content that sometimes occur during a day or between days.

The ability of a selected tree to consistently maintain its position, relative to adjacent standards, is a prime factor in determining its status as a superior tree.

The progressive-sampling program was in full operation during the 1964 and 1965 sugaring seasons in Maine, New Hampshire, Vermont, Massachusetts, and New York, and during the 1965 season in Pennsylvania. Some 70 local, state and extension forestry personnel, under the general direction of William J. Gabriel, participated in this work. Orientation sessions to provide background information and instructions for the field operations were conducted before the sugaring season in each State. A summary of accomplishments by States in the 1964 and 1965 surveys is presented in table 1.

Table 1. - Number of sugarbushes surveyed and trees selected, by States, 1964 and 1965

	Sugarbushes surveyed			Trees sampled			Trees selected		
	1964	1965	Total	1964	1965	Total	1964	1965	Total
Maine	4	1/	4	400	1/	400	2	1/	2
Massachusetts	34	0	34	2,451	0	2,451	33	0	33
New Hampshire	7	1/	7	391	1/	391	9	1/	9
New York	11	49	60	665	4,057	4,722	9	62	71
Pennsylvania	--	43	43	--	3,823	3,823	--	26	26
Vermont	34	8	42	2,894	559	3,453	42	6	48
Total	90	100	190	6,801	8,439	15,240	95	94	189

1/ Reports not yet received.

The field survey portion of the selection program is scheduled for termination in 1968. The next logical concern will be what to do with the selected superior trees. Our intentions now are to make a final screening of all the selected trees in 1968, and from these choose about 50 of the most promising ones for propagation and intensive breeding efforts.

Propagation Studies

For the benefits of a selection program to be realized, the trees exhibiting superior attributes have to be propagated. Two approaches are planned: (1) Vegetative propagation and (2) sexual propagation involving controlled breeding.

The initial emphasis will be on vegetative propagation. In the summer of 1968, we will try to propagate all the finally selected superior trees by cuttings. Insofar as we are successful, new individuals identical to the parent tree in sap production capabilities will thus be produced. In 1969, a breeding program with selected parents will be started, with the objective of developing genetic strains of trees characterized by high sugar-production capabilities.

Methods of Vegetative Propagation

I would now like to consider certain aspects of the current research program in vegetative propagation of maple at Burlington. There are three possible methods: (1) Grafting, (2) air-layering, and (3) twig cuttings. Grafting has found wide usage and is the principal method employed by nurserymen in ornamental sugar maple propagation. Air-layering and the rooting of cuttings are less frequently used and, when used, have generally been less successful.

Grafting. --Grafting as a means of propagating superior maples has been the subject of only one small study at our Station. In this instance, Santamour and Cunningham in 1964 investigated the effect of rootstock on the sugar content of grafted material. They found considerable variation in sap sugar content among bud grafts from the same tree when grown on seedling roots of different genetic origins.

Since the environmental factors were reasonably uniform, rootstock influence appeared to be the most probable cause of the variation.

Air-layering. --Air-layering of sugar maple has been investigated by Cunningham and Peterson (1965). Their work has demonstrated that branches of sugar maple can be rooted by air-layering and that branches so rooted can be overwintered and grown with moderate success.

To produce air-layers, reasonably vigorous branches in the outer crown of a tree are selected for treatment in late May or early June. At the node marking the base of a two-year-old wood, which may be some 20 inches or so back from the branch tip, the bark is removed in a girdle one inch wide. The girdle is dusted with rooting hormone and then is completely encased in damp sphagnum moss, which is held in place with a wrapper of clear polyethylene film securely tied at each end. After about a month, the air-layers are inspected at weekly intervals, and when roots can been seen growing through the sphagnum the branch is cut below the girdle and planted in the nursery. About 90 percent of the branches that develop roots do so within nine weeks after treatment.

Cunningham and Peterson provided shade and automatic intermittent sprinkling for their planted air-layers until the end of August. After that, the plants were exposed to the natural weather to harden off. Survivals over the first winter varied from 11 to 48 percent among layers from different trees. In general, survival was greater among the plants that had rooted earlier and thus had been outplanted a longer time.

Twig cuttings. --Several investigators have attempted to propagate species of maple by cuttings. Studies were conducted at the University of New Hampshire from 1943 to

1957. Albert G. Snow of our own Station worked with maple propagation during the period 1939-41. Several factors that might affect rooting were investigated. These included individual tree variation, age of parent tree, date of cutting collection, length of cuttings, propagation conditions and media, and hormone treatments. Although most of these factors were shown to have some influence on rooting, no completely satisfactory procedure was found.

Results of the first experiments at Burlington in propagating sugar maple by greenwood twig cuttings were reported by Gabriel, Marvin, and Taylor in 1961. These indicated that both parent tree and propagation medium influenced rooting percentage. However, rooting proved to be only the first and easiest step, as almost all the rooted cuttings died during winter storage. Our work since then has been a continuation and expansion of these initial efforts, with particular emphasis on the overwintering problem. Some of the earlier investigations elsewhere also revealed serious problems in overwintering rooted sugar maple cuttings.

Our collection and propagation procedure for the past few years has been as follows: Cuttings are usually collected from mature trees during late June or early July. They are transported in water-filled pails to the greenhouse, where all except the terminal three or four leaves are removed. The cutting is cut to a standard 5- to 6-inch length, and a small strip of bark is removed on opposite sides of the basal end. The wounded area is then treated with a root-inducing hormone (indolebutyric acid in either liquid or powder form). Thus prepared, the cuttings are stuck to a depth of 1-1/2 inches in small (4- by 5-inch) perlite-filled perforated polyethylene bags. These bags are placed in flats and the flats are then transferred to the propagation chamber.

The propagation chamber is a low outdoor structure--approximately 10 feet wide and 80 feet long. It is constructed of clear polyethylene plastic film over a wooden framework. Incandescent 100-watt lamps over the center of the bed at 8-foot intervals provide light for extended length of day. An automatic mist system, operated either by an electronic leaf or an electronic control activated by sunlight, maintains moist conditions and high humidity.

Utilizing this procedure and equipment, it has been possible to obtain roots on the cuttings within 8 to 10 weeks. Rooting percentages have varied from 40 to 60 percent. Such percentages, while not optimum, do provide enough material to work with. It is believed that rooting percentages can be increased through more rigid environmental controls during the propagation period.

Emphasis on Overwintering

Present emphasis is on increasing the overwinter survival of rooted cuttings. Root-cellar storage and direct outplanting have been tried with poor success. Temperature-controlled refrigeration treatments also have been tried--cuttings were overwintered at temperatures of 20°, 28°, 33°, and 38° F.--all under conditions of high humidity. The respective survival rates were 0, 5.8, 9.1, and 3.2 percent. These values certainly can't be considered as optimum.

The importance of well-branched roots was demonstrated in a 1960-61 study. Overwinter survivals, at 33° F., were 22 percent for a group of cuttings possessing well-branched roots as compared to only 4 percent for a group of cuttings with sparsely branched roots. Obviously we should attempt to create conditions during the propagation period that favor branched root development.

Work on overwintering treatments is continuing. We have tried mulched cold-frame storage, mulched outplanting, and sphagnum-mulched refrigerated treatments--all without appreciable success.

Our present attempts involve a slightly different approach. We now have a study under way to determine how date of twig collection affects rooting ability. We believe that if cuttings can be adequately rooted earlier in the season, so that they can be outplanted in time to make some growth during the same summer, overwinter survival will be greater. Results in our 1965 rooting trials indicate that we may be able to obtain earlier rooting by collecting the cuttings during the first part of June.

We are also considering dormant feeding of cuttings while in storage. It is known that some root growth can and does occur during the dormant season. Recent work at Cornell has shown considerably greater root growth by selected ornamental cuttings when supplied with nutrient solutions during a portion of the dormant season.

Future Plans

Relationships between tree vigor and rooting ability need to be established. We also believe more attention should be given to preparing the tree and the cutting for root formation.

Tree fertilization might be one approach. The possibility of banding or girdling to increase carbohydrate concentrations in the cutting before it is removed from the tree should also be investigated.

Finally, we need to fully understand the relationship between the environmental conditions of propagation and the type of roots developed. Water content of the rooting medium and aeration within it are two examples of factors that may affect development of branched roots.

The propagation problem will have to be effectively solved before full use of the trees in the current selection program will be possible.

WISCONSIN'S CENTRAL SAP EVAPORATOR PLANT

By Adin Reynolds, Reynolds Sugar Bush, Aniwa, Wis.

When it was suggested that I give a talk on Wisconsin's central evaporator plants, I was uncertain as to what area of such an operation might be of most interest. There has been a number of articles published on central evaporator plants; one or two appeared in the "National Maple Digest." There has been at least one bulletin printed on the economics of a central evaporating plant. Now these articles covered much detail and although I could not agree with everything published, yet I wondered just what I could add that might be of interest. I finally chose to discuss some facets of our own operation which, of course, I felt the most familiar with.

To give a background on our operation, I might reach back into the years 1918 or 1919, or some 47 years ago when we first experimented with buying maple sap from our neighbors. This was not on a big scale and we did not call it central evaporation. We tapped only a few hundred trees then and had only one medium-sized Champion Evaporator. Our growth was pretty slow for several years; but, in the 1940's we purchased larger and more modern evaporators. We were developing more and better markets and growth of our operation was more encouraging. We now own and operate three central evaporating plants in north-central Wisconsin. These three plants serve parts of three different counties and are located in sort of a triangle with a distance of 20 to 25 miles apart. Thus, each plant serves an area with a radius of about 10 miles. We have some exceptions whereby a few patrons haul their own sap as far as 25 miles. We provide tank truck hauling service for roadside pick up of sap where this is practical; however, we encourage the sap producer to deliver his own sap if possible. We have something over 100 patrons supporting our three plants.

This last season these three plants processed the sap from over 100, 000 taps. This included sap purchased from other tree owners as well as our own; and, if we just assume that this sap was all purchased, it would show a figure of about $35, 000 paid out for sap in this area. If we would add the processing and other handling and packaging costs, we would double this figure, or about $70, 000. Of most importance, this money stays in the area and is a very welcome income to the area.

As sap reaches the plant, it is tested for sugar content and metered and filtered into underground storage. We are not arguing the merits of underground storage; however, they do have at least two advantages; (1) they allow the use of gravity for filling and (2) the temperature the frozen underground storage provides--that is, the area around the underground tank is frozen and keeps the sap extremely cold. However, these tanks do require daily cleaning. We have miles of galvanized and plastic pipe lines feeding sap into our home plant from some of our own tree areas. Sap is automatically pumped from these storage tanks to the evaporator. We now operate 10 large modern evaporators, most all are 6' machines and up to 20' long and all are oil fired with a total of 23 oil burners. They burn a total of about 250 gallons of fuel oil per hour. With normal brix sap, we have a take-off of 85 to 90 gallons of sirup per hour. The 1965 season with exceptionally high Brix sap pushed our output to over 100 gallons of sirup per hour. This, of course, is much above our average. The evaporators are all on the same floor level and are operated in a series. Pumps are used to move the sap from one machine to another. In other words, as the sap is automatically fed to the first evaporator, it travels the complete circuit of the pans; and, as fast as it reaches the draw-off, it is pumped to the next evaporator. It travels around this machine the same way and then is pumped to the next one. After circling the four machines, it is close to the sirup stage and the automatic draw-off is clicking quite steadily. Incidentally, I might point out here that the automatic draw-off

that we use was developed at this Laboratory. We now use several of these draw-off valves ourselves and we have sold many dozens of them. They are trouble-free and positively dependable. The thermo switch controls of these draw-off valves are being improved. We have had the privilege of using a new thermister control unit on trial the last two seasons and this works with absolute perfection. This, too, was a product of this Laboratory and it is hoped will be available commercially very soon. I would like to dwell longer on this subject but time does not allow it now.

Each plant is completely automated to where one man can operate it alone with the exception of buying sap and the sanitation work. As sirup is being drawn quite steadily from the final evaporator at about 60 Brix reading, it is semifiltered and pumped to steam kettles for final finishing. It then goes into storage tanks.

We have a series of twenty 1,000-gallon cylinder type tanks where the sirup remains in storage until final packaging or shipping and, of course, the sirup in these tanks is protected by ultraviolet lamps.

The packaging is a year-round operation and provides steady work for several people.

We operate a retail store on a main highway close to our home plant. This has proven an excellent way to merchandise maple products; and, of course, in Wisconsin we sell a lot of cheese also.

Another service of a central evaporating plant to an area is providing a market for the surplus sirup of all or at least many of the smaller sirup makers. This central evaporating plant could not exist or have grown to any size without having developed a dependable market; and with this established market, a plant would generally welcome the handling of additional sirup to assure fulfilling volume contracts.

I have not presented this paper as a success story, but only to show that in Wisconsin we have demonstrated that central sap evaporator plants can, and will work and also grow with proper management.

ECONOMIC ASPECTS OF WISCONSIN'S CENTRAL EVAPORATION PLANT

By T. A. Peterson, Extension Forester, University of Wisconsin, Madison

As is true of all maple regions, Wisconsin's maple industry started as an adjunct of the family farm enterprise. About a century ago 70 percent of this State's maple crop (275, 000 gallons in 1860) was in the form of sugar--a staple household item. The small family-farm operation still represents the largest segment of the industry; however, the non-farm element makes up an ever-increasing portion in Wisconsin.

The central evaporation plant has struck the imagination of the maple industry in recent years. This idea, however, is not new in Wisconsin as evidenced by the account of Adin Reynolds of Aniwa. There has been a surge of interest and activation of central evaporation plants here within the past five years which correlates well with such developments elsewhere in the maple region. Willits has cited the obvious advantages of the central plants over small traditional sirup operations in the "Maple Producers Manual" U. S. D. A., Agriculture Handbook No. 134; 112 pp. (Revised 1965) as follows:

(1) Separation of Sap-producing and Sirup-making and marketing skills
(2) More efficient use of required capital investment.
(3) More efficient use of modern equipment and labor.
(4) Wider use of the local untapped maple resource.
(5) More uniform and higher quality product for consumer markets.

Currently there are at least twelve sap-buying operations in the State--mostly "small-sized" in terms of the Pasto and Taylor study published in 1962. As many of you might recall, I was very optimistic over the Wisconsin central plant developments under way at the time of the last triennial conference on maple. Several small plants began operations that year and others were in various stages of planning and promotion. The factor that perhaps blunted the scale of envisioned development more than any combination of other factors has been weather. During the past three sap seasons we have produced only one-third to one-half of our normal maple crop. An occasional poor display of "dame-weather vicissitude" is to be expected, but a succession of three straight poor sirup crops is enough to make even the most ardent advocate of central evaporation plants exercise extreme caution.

Because of the extremely poor seasons in recent years I cannot present a comprehensive economic report on our central plants. However, to give you an indication of the economics involved and the relative impact these operations can make on local communities, two separate cases will be cited. These are not to be construed as average or typical plants--as yet I don't know what these are. It should also be remembered that, during the specific record period, neither plant was operating at full capacity for the equipment involved.

CENTRAL EVAPORATION PLANT A

Plant A is situated at a small village intersection. The equipment was adapted to a relatively new building not specifically constructed as a saphouse.

Equipment includes two 6' x 16' oil-fired evaporators in series. Six oil burners use a total of about 50 gallons of fuel per hour. Automatic draw-off controls are employed. The equipment will handle about 600 gallons of sap and produce about 15 gallons of sirup per hour. Sirup is pumped to gravity filter systems, a gas-finishing system, and a canning tank.

CENTRAL EVAPORATION PLANT B

Plant B is located one quarter of a mile off a State highway. The equipment is less than 5 years old, except for a small, used evaporator. A closed building, on a concrete slab, was newly constructed of native, rough-sawed lumber.

Equipment includes a 6' x 20' evaporator and a 3' x 10' evaporator in series. Both are oil-fired, using 32 gallons of fuel per hour. Both are equipped with steam hoods and automatic drawoff controls. Raw sap enters the larger unit and is then pumped over to the smaller unit for semifinishing. A gas-fired pan is used for sirup finishing. The equipment will presently handle about 350 gallons of sap and produce about 9 gallons of sirup per hour. Provisions have been made for a future increased capacity within the building.

After a pan-burning experience the very first year, the plant manager installed a safety device whereby the float system on the sap intake side automatically shuts off the oil burners when the liquid level in the sap pan reaches a critical depth.

A 12,000 gallon, lined, concrete tank is used for sap storage. Ultraviolet lamps are used under the tank cover. Purchased sap is picked up, metered, and trucked in by the plant.

This central plant is normally operated by two men, including the sap hauler.

Data are given on central evaporation Plants A and B and on sap suppliers.

Six implications might be drawn from these two examples of central evaporation plant operations.

(1) Local communities reap substantial economic benefit from the existance of even a small central plant. As in these examples, the available maple tree resource would otherwise be returning little to the owners.

Aside from the income due to sap sales, money is being circulated in the communities in the form of cost items such as interest, taxes, insurance, utilities, fuel, and labor. While these are not dollar amounts rivaling government budget figures, they do represent <u>additional</u> dollars in local economies.

(2) The amount and the quality of sap (as all sirup producers know) do affect gross income and the margin of return on a sap or sirup operation. In a poor sap season the fixed costs become proportionately higher per gallon of sap collected or sirup produced. Under the concept of central evaporation, where sap production and sirup-making functions are separated, not only are capital investments, equipment, and labor used more efficiently, but also risks due to poor seasons are shared.

(3) The matter of plant location grossly affects product marketing. Good location relative to retail traffic or to retail market outlets can increase operation returns. There is a favorable net difference, for example, in a $6. per gallon retail sale over a $4. per gallon bulk sale.

(4) When adequate markets do exist--or at least can be developed--the central plant manager might well carry the processing beyond the sirup stage. While actual figures and experience are not available for the examples cited, there is supporting evidence that further processing of quality confections from sirup can substantially

CENTRAL EVAPORATION PLANT A

	Per gal.	Amount	Total
A. Investment in plant and equipment			$10,000
B. Income 1/ (5,000 gal. of sirup)			22,500
C. Production Costs:			
Fixed costs per gal. of sirup: 2/	$0.27		
Depreciation	.10	$ 500	
Interest	.08	400	
Taxes	.01	50	
Insurance	.02	100	
Repairs	.03	150	
Utilities	.03	150	
Variable cost per gal. of sirup: 2/	2.53		
Sap supply 3/	1.69	8,448	
Labor	.25	1,250	
Fuel	.43	2,090	
Sirup transport	.03 4/	110	
Containers	.40	750	
Total costs per gal. of sirup:	2.80		$13,998
D. Margin on operation			$ 8,502

E. Return on capital investment of 85 percent.

SAP SUPPLIER DATA FOR PLANT A

Taps (18 patrons)	number	25,000
Volume sap sold	gal.	176,000
Av. yield per taphole	gal.	7
Av. Brix of sap	percent	2.4
Sap receipts	dollars	8,448.00
Receipts per taphole	cents	.34

1/ 1,875 gal. retailed at plant at $6 a gal.; 1,875 gal. sold bulk at $4 a gal.; 1,250 gal. commercial grade sold bulk at $3 a gal.

2/ Fixed and variable labor costs not separated. Costs are listed for average of sirup.

3/ Sap schedule: 2 percent at .04 a gal.; 2-1/2 percent at .05 a gal.; 3 percent at .06 a gal.; and so forth. 176,000 gal. sap, av. 2.4° Brix and 4.8 cents a gal.

4/ $.035 a gal. transported; .40 a gal. retailed.

CENTRAL EVAPORATION PLANT B (1964 data)

	Per gal.	Amount	Total
A. Investment in plant and equipment			$7,000
B. Income 1/ (1,800 gal sirup)			8,425
C. Production Costs:			
Fixed costs per gal. of sirup: 2/	$0.62		
Depreciation	.18	$325	
Interest	.26	460	
Taxes	.08	140	
Insurance	.07	126	
Utilities and Repairs	.03	54	
Variable costs per gal. of sirup: 2/	.67		
Sap supply 3/	1.71	3,324	
Labor	.21	375	
Fuel (oil and LP gas)	.54	972	
Total costs per gal. of sirup:	3.08		$5,776
D. Margin on operation			$2,649

E. Return on capital investment of 38 percent.

SAP SUPPLIER DATA FOR PLANT B

Taps (20 patrons)	number	10,000
Volume sap sold	gal.	61,700
Av. yield per taphole	gal.	6
Av. Brix of sap	percent	2.4
Sap receipts	dollars	3,324.00
Receipts per taphole	cents	.33

1/ 500 gal. at $3.85 a gal.; 1,300 gal. at $5.00 a gal.

2/ Fixed and variable labor charges not separated. Costs are listed for average of sirup.

3/ Sap schedule: 2 percent at .04 a gal.; 2-1/2 percent at .05 a gal.; 3 percent at .06 a gal. and so forth. 61,700 gal. sap purchased, av. 2-1/2° Brix, and 5.4 cents a gal.

Pick-up charges: one-half cent a gal. within 20 miles; three quarters cent a gal. over 20 miles.

increase income values with correspondingly larger returns to both labor and capital.

(5) To make the most efficient use of capital investment, equipment, and labor, the central plant should be operated to its full capacity. This capacity must be geared to the available tree resources. Where actual sap procurement is below the desired level, whether due to a lack of local sap producers or to poor sap runs, the use of long-haul, large tanker sap transports may be feasible. This is now under study by one multiple-plant operation to stabilize sap intake at each location.

Should large volume, long-haul transport prove feasible it may well affect the planned location and establishment of future central plants within the maple region.

(6) In these days of central evaporation plant planning and establishment, a major recognized obstacle confronting local people is one of available investment credit. While this will continue to be an imposing factor, I believe the dearth of $150.-a-week men poses by far the biggest problem. The implication here is that ordinary labor is generally no problem but good plant managers or operators are hard--even impossible--to find.

The crux of the problem for many potential communities where central plants are feasible is to find trained and experienced plant operators. It follows that where skilled men are employed the chance of business success is best. With the accompanying lowered business risk there will likely be more readily available investment capital.

To meet the obvious need for skilled plant operators, possibilities are now being explored in Wisconsin to provide this education and in-service training. Such a program could involve trainees from several States.

TRENDS IN MAPLE PRODUCTION IN NEW YORK

By Fred E. Winch, Jr., Extension Forester, Cornell University, Ithaca, N. Y.

In New York the trend among maple producers is to get bigger. This has definitely accounted for the fact that the State has produced what has come to be called a "normal crop" even in a year such as 1965 when a large area of the State produced only 25 to 50 percent of a crop. To augment and encourage this trend, several food processing companies have been exploring the possibilities of purchasing and processing sap for their own special uses. To date most of these companies have been on the "processing-crop fringe" of the maple area and not located so as to be entirely surrounded by maple forest land, which is generally located on higher and rougher land than that used for processing vegetable crops.

There has been a decided growth in the size of "farmer" owned maple enterprise as well. In 1962 our best figures for the State showed 6 producers with a total of 21, 000 gallons; 50 with a total of 68, 000, and 1, 750 (averaging 250 gallons each) with 437, 800 gallons; this totaled 526, 500 gallons. In contrast, in 1965 there were 6 farmer producers set up to produce 27, 000 gallons, 119 set up to produce 142, 000 gallons, and 1, 700 (average capacity of 275 gallons) for 46, 000; this totaled 637, 000 gallons. In addition we have a plant which can operate to produce up to 20, 000 gallons if sap were made available. With a relatively poor year in many producing areas, our production in 1965 exceeded 425, 000 gallons, or roughly 60 percent of a crop Statewide. In some areas only 25 percent of a crop was produced.

How did this growth come about? The answer is primarily through technological advances which have enabled an operator to handle more sap with less manpower and with bigger installations of equipment. This means more efficiency from tree to sirup container.

Tapping

In the field where tapping takes place, two advances have improved the position of the producer.

1. The first of these has been the wide and rapid acceptance of the taphole pellet, the first field trials of which were discussed in Philadelphia 3 years ago. Several types and brands of these are on the market at the present time and their easy availability has had an influence on tapping techniques and sap flow which leaves little question as to their value now. The greatest change attributed to pellets is the change in the tapping season. Previous to the advent of the taphole pellet, tapping of the tree was confined to a relatively short calendar period, usually just as sap weather occurred. This was traditionally the very last of February and early March in the earliest areas to March 15 and later in the more northern and higher sections. Now tapping may occur in mid-January through February in all sections without fear of consequent taphole drying. It is estimated that 95 percent of the bushes tapped in New York use pellets in 90 percent of their tapholes with a consequent increase in sap flow.

2. Tubing is the second reason for more efficiency in the sugar bush. Early work in the State with tubing intrigued producers and from the attempts of producers and manufacturers alike, a "system" was developed, which has been adopted by most large producers in the State. Early it was found that the best results were from graded lines in most sections of the State and especially in the colder sections. Lines have been graded by placing the main lines on evenly graded terrain; by developing uniform grades with

bulldozers; or by placing graded wires supported in permanent locations on which the main lines of tubing are attached during the season of use.

The installation of the system is usually done in two stages: First, the tapping, pelleting, and placing of drop lines of 4 to 5 foot lengths takes place early in the season. Secondly, previous to the "first run" the main lines are installed and are attached to the feeder tubing. The system is well described in the publication by Sipple and Willits.[1]

In the last few years many refinements in tubing installation have taken place. One of the first was the use of junction boxes or dumping stations at breaks in the slope. These become both vents and equalizing tanks for the lines. Another refinement on land with limited slope has been the use of underground metal storage tanks at the end of graded, wire-supported, lines. These underground tanks have the advantage of uniform temperature throughout the season and are available for dumping in cold weather; dumping is accomplished by vacuum or self-priming pumps on tractors.

The use of vacuum pumps of varied arrangements has been an outgrowth of the use of tubing. Several different variations of the setup with vacuum are used. All have proven to be useful in the field. Probably the ultimate has been reached in one Lewis County installation which is thermostatically controlled--when the air temperature reaches a certain level, at which sap begins to run, the pump goes on--when the temperature falls to 28° to 30° F. the pump shuts off, as has the sap flow.

Probably the greatest boost to the use of tubing has been the regional autumn demonstrations of tubing installation, take-down and replacement. These demonstrations have been extremely helpful in a "show how" of the recommendations in the Sipple and Willits publication. A section of the bush is selected. A discussion of location of main lines, laterals, and vent tanks is held. Then the tubing direct from the roll is cut into drop lines, with spiles and vents attached; the trees are tapped, pelleted, and drops placed in service. The operator (a skilled user of tubing) then reels off the tubing, cutting it as needed. Then the tubing is taken down but drops are left in place. A second crew then places the tubing in service again. With these techniques a family can handle 4,000 taps with ease to produce 1,000 gallons of sirup.

Sap Handling

Efficient handling of the raw product is a must if sap is to be processed into high quality products.

1. Mechanized transport and handling of sap have been a prime factor in increased efficiency. Pumps--self-priming or vacuum of all types--enable one man to gather sap from tanks, collection dumps, or even individual roadside taps. Motorized transport by tractors or trucks is common now. The combination of these two tools is a natural. Further discussion is not needed.

2. Improved storage and sap handling are of utmost importance. I need not dwell on the need for sanitation in the saphouse as a followup of the use of pellets. One "shot"--the pellet--does not do the total job. Filtering of sap and sterilization (or a better term--sanitization) of the storage tank and of other equipment are important. Ultraviolet light is

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[1] Willits, C. O. and Sipple, Lloyd. The Use of Plastic Tubing for Collecting and Transporting Maple Sap. U.S. Agr. Res. Serv. ARS 73-35, 19 pp., November 1961.

a useful tool--its adoption in the last 3 years has seemed phenomenal to me. Results have shown the expense to be justified. Along with this tool goes the rapid processing needed for a quality product.

Processing

Strides have been rapid in better methods in the saphouse.

1. Evaporation technique improvements are responsible for the trend in increased size of operation. In New York the trend toward more evaporation surface has been one which depends, not on larger evaporators--6 x 20's let's say--but on multiple evaporators in series operated by one man using easily controlled fuel, oil or gas, or the combination of the two. Wood, the fuel of "sugarin'" days of old, does not lend itself to large operations because of the drain on manpower both in the woods where the fuel is prepared and in the evaporator house where skill is needed to properly fire the woodburning evaporation equipment. Consequently, most of the larger farmer units are now installing one or more evaporators and pans in series. In New York the majority of these have been one or more flue pans followed by an evaporator and gas-fired finishing pan which may well be operated by one man. Our experience in New York has been that one oil burner of adequate size per unit (flue pan or evaporator) keeps costs minimal and produces an even flow of sap to sirup. Producers have tended to develop a standard unit which consists of one or more 5' x 10' flue pans, 5' x 14' evaporator, and a small gas-fired or steam evaporator pan or standardization pan. In fact one farm service organization in the State has built cinder block arches, installed oil burners and oil tanks in many of the maple regions for those producers not willing to undertake the construction themselves. Such a multiple setup may be a 5' x 14' evaporator with 5' x 10' flue pan costing about $775. (1964 prices), a high pressure gun-type oil burner of 14 to 16 gallon an hour capacity which would cost about $350. without controls. Ahead of this evaporator should be placed a 5' x 10' flue pan at a cost of about $650. fired by an oil burner of 12 to 13 gallon an hour capacity at a cost of $220. without controls.

With 2.5 percent sugar sap the above evaporator (5' x 14') produces 6 gallons of sirup per hour, or 60 gallons per 10 hour day; the addition of the flue pan 3-1/2 gallons an hour production is added, or 35 gallons per 10 hour day--a total of 95 gallons in 10 hours or 225 gallons in round-the-clock operation. Additional 5' x 10' pans will add 3.5 gallons an hour. The 5' x 10' flue pans are also interchangeable and flexible enough so that only one "spare" may be needed by cautious operators--or one unit may be shut down if damage occurs without disrupting the entire operation but only reduce it by 3-1/2 gallons an hour.

All in all, the operators with large operations have been able to become efficient with the better, more easily controlled fuels. With larger volumes of such fuel they are also able to get bids for fuel oil at much more reasonable prices. A 500-gallon producer will use 1,400 to 1,600 gallons of fuel oil per season, the 1,000-gallon producer 3,000 to 3,200; and the 4,000-gallon producer 12,000 to 13,000 gallons. Volume purchase may drop prices at least 2 cents per gallon for fuel oil or 5 to 7 cents per gallon of sirup--a worthwhile saving.

In the discussion of the evaporator, I have not mentioned covered pans. These have been so well accepted in New York that any new installation automatically includes them, but they are a factor in the larger operation and the efficiency of any producer. An additional value, of course, is the sanitation of the sugarhouse--a factor of importance with stringent food inspection present or in the offing.

New efficient evaporators mean we also need better testing equipment. Due to the work of the folks here at the Laboratory, we have these good, sensible and sensitive

thermometers for general use in the industry. On the drawing board and pilot model stages are automatic equipment for the withdrawing of finished sirup from the evaporator, which may eliminate the need to calibrate frequently each day and reducing calibration to but once a season. Working models have been field tested and have proved adequate. With a more exacting clientele the days of the $3. thermometer are gone and the $40. one about to phase out--a $100. electronic device can do the job exactly.

2. Filtering has changed radically. For the most part New York producers are content to use felt filters rather than the pressure filters. With large volumes of hot sirup, the flat felt stays hot and allows up to 100 gallons of sirup to pass through the filter before it needs washing. Artificial fiber, flat-style filters are most commonly used among the top 125 producers because of the rapidity of filtration and ease of washing. Pre-filters are common.

3. Pumps to handle sirup are a must these days. On our tour in Wyoming County this year, the ultimate was seen in sirup handling. Sirup is filtered from the evaporator not the finishing pan. It is pumped to the standardizing or finishing pan, then pumped to filters, and finally pumped into overhead storage where it is stored in bulk.

4. Sirup storage methods are largely changing. Bulk storage is the trend with the bulk storage sanitation controlled by ultraviolet lights over the tank. From these tanks a standardized sirup for processing or packaging may be drawn off at any time. Such storages may handle up to 5,000 gallons and have proven to be a worthwhile man-saver for the larger producer.

Marketing

In no way must the previous emphasis detract from the trends in marketing. It is hard to determine which came first--the market or the production. We can be safe to say they developed hand in hand. Ideas in marketing have changed--and drastically--in the last 5 years.

Most large producers with relatively few exceptions have developed better retail markets. This has developed to the point where the market is still exceeding supplies and at this season, unfortunately, there is a lack of product to sell Statewide. The producer has developed this in many ways. In Allegheny County a pancake house operated in conjunction with the saphouse is the answer. Another Allegheny producer's wife is developing a line of maple confections which is rapidly expanding the market. Lewis County producers are bringing their crop to the roadside in attractive saphouses or roadside stands and featuring many products other than sirup. Mail-order business has grown and will continue to increase if some of the headaches of mail shipment can be reduced. We are fortunate in New York to have a population of 17 million people. Our population is growing 10 percent per year--if we just keep abreast of the present market our producers must expand to 700,000 gallons by 1975. If they market to a better proportion of the population (increase the buying public) which they are doing now this production goal should probably be attained by 1970.

In addition to the trends in retail marketing a great deal of thought is going into more efficient marketing methods for bulk sirup. Several counties with large amounts of bulk sirup are exploring ideas for more coordinated marketing. Buyers outside the traditional bulk markets are making their needs known. Inquiries for substantial supplies of pure maple have come from as far away as California, and European markets are not out of the realm of possibility. Food processors referred to in my opening remarks present a possible outlet for farmer-made sirup as well as that made in their own plants. Promotion

by producers organizations has been beneficial to the maple enterprise. In the last few years the producer-organized booths at state, regional, and county fairs have increased dramatically. I estimate that sales of maple products in 1965 in such booths in New York exceeded 10, 000 gallons of sirup equivalent. This is a more meaningful figure when it is realized that the sirup was sold in pints and quarts and that the molded sugars were in 1 to 4 oz. sizes. Maple products in the form of sugars, cream, and confections continue to expand the need for pure maple production.

Summary

These opportunities have made it possible to develop small "central" evaporator houses. Added volume of sap, added production, and longer or year-round marketing has triggered an industry, which is growing and must continue to grow. New techniques from the tree to the market are responsible for a revitalized industry, which is keeping much of New York's hill country "in the black."

THE NATIONAL MAPLE SYRUP COUNCIL

By Linwood Lesure, President, Ashfield, Mass.

Six years have passed since the first establishment of the National Maple Syrup Council right here at the time of the Fourth Annual Maple Conference. The year of the Conference, 1962, also saw the birth of the National Maple Digest as a direct action of Council meetings. Lloyd Sipple, editor of the Digest since the start, will report on the work. The Digest has made a fine start in improving communication among maple producers. The maple groups are so scattered and unorganized that most had little idea of what was happening in other maple areas.

The Fourth Annual Council meeting was held in 1963 at Cooperstown, N. Y. This meeting was devoted primarily to problems presented by the Vermont delegation. Heavy crops of sirup in Canada and the United States made Canadian tariff regulations of importance to some of our States so the Council set up a committee to work on the problem. As in previous years, the matter of a grade that could and would be recognized in all States was discussed. It was decided that New York and Vermont, having a majority of producers, would try to come to some understanding and would report their recommendations at the 1964 Annual meeting. Maine, having sent an observer and a request for membership, was voted in as the ninth State and Ted Harding of Athens, Maine, was recognized as the delegate. Officers elected were Linwood Lesure of Ashfield, Mass., President; Adin Reynolds, Aniwa, Wis., Vice-President; Putnum Robbins, East Lansing, Mich., Secretary-Treasurer. An invitation to meet in Massachusetts in 1964 was accepted.

The Fifth Annual Meeting of the Council held in the Greenfield area of Massachusetts in 1964 found directors present from the nine member States and observers from Connecticut and Minnesota. The first day included a maple tour, a formal program of several invited speakers, and a banquet in the evening. A committee to study and suggest revisions to the constitution and bylaws was appointed with Ture Johnson as Chairman. Other members of the Committee were Leland Schuler, P. T. Robbins, and C. O. Willits. The committee was instructed to report at the 1965 meeting.

Much discussion by Directors and members centered around the matter of standard grade designations. The following motion was finally made and carried: "That the National Maple Syrup Council adopt the color standards as established by the United States Department of Agriculture--LIGHT AMBER, MEDIUM AMBER, DARK AMBER, and DARKER THAN DARK AMBER." It was also voted to encourage producers to use the new grades along with their own State grades.

It was voted to hold the 1965 meeting at the Research Laboratory in Philadelphia at the time of the Maple Sirup Industry Conference.

The Council voted to commend the College of Agriculture of the University of Massachusetts for its work in the dieback disease of maples and to send a copy of the resolution to the Dean and to Extension heads.

It was moved and passed that the Council support the drive of the Vermont Maple Association and others to have an additional $90,000 assigned for the use of the U. S. Forest Service at Burlington.

The motion was carried that a letter be sent to all major sirup can manufacturers pointing out the fact that improvements were much needed in tin containers.

All officers were reelected to serve for the coming year.

We met here yesterday for a full day of work. The constitution and bylaws were given a thorough workover. Procedure for qualifying delegates to the Council was clearly outlined. In general the rules, which were purposely left quite loose at the time of its adoption several years ago, were tightened up. Committees for Marketing and for National Maple Queen Contests were authorized. The Council voted the official National Maple Queen Contest for 1966 to be held in Ohio.

Officers elected were, President, Adin Reynolds, Aniwa, Wis,; Vice-President, Ture Johnson, Burton, Ohio; Secretary-Treasurer, Lloyd Sipple, Bainbridge, N. Y. Sipple was also elected to serve as the editor of the Digest.

Associate members elected for 3 years were as follows:

Putnam Robbins, Michigan
J. C. Underwood, Philadelphia, EURDD
Extension Foresters--Fred Winch, New York; Edward Farrand, Pennsylvania; and Raymond Foulds, Vermont

Extension Forester Edgar Lott of Indiana and the Extension Forester, Marvin Smith, of Minnesota were elected associates for 1 year.

An invitation to hold the 1966 Annual Meeting in Wisconsin was accepted.

We were active in several fields. I think we can consider that we had an important part in retaining the maple research here at the Laboratory. Also I like to think we helped in some small way in getting a larger grant for the use of the U. S. Experiment Station at Burlington, Vt.

I am happy to turn the leadership of the Council over to the new president, Adin Reynolds. I know that it is in good hands.

THE "NATIONAL MAPLE SYRUP DIGEST"

By L. L. Sipple, Editor, Bainbridge, N.Y.

At the Fifth Maple Conference held in this Laboratory in 1962, the report I gave on the National Maple Syrup Council included a brief history of the "Maple Syrup Digest," which, at that time was just 1 year old. As some of you will remember, it was supposed to be a newsletter, but before the first issue was printed it had grown into a magazine (all 12 pages of it).

You might say it was a "problem child." We had no organization, no operating capital, no mailing list, and then, to make matters worse, the Postal Department said we could not qualify as a non-profit organization!

During the past 3 years many of our problems have, in one way or another, worked themselves out. We now have an organization which consists of an editor, reporter, circulation manager, rewriter, advertising agent, set-up man, proof reader, and errand boy--all of these positions held by the same person. We have a mailing list that started at 5,200, increased to 7,000. After we made almost 2,000 additions, deletions and corrections, the final list consists of 6,700.

The Digest has grown to 20 pages. This allows us to add new departments from time to time, more "commercials" to pay the bills, and almost doubles the number of mistakes we make. We now have working capital, to be specific, $425. worth, but the Postal Department still doesn't agree that this is a non-profit organization. The financial report, which I presented to the National Maple Syrup Council yesterday, is as follows:

"National Maple Syrup Digest"
Bainbridge, N. Y.

Financial Report for Fiscal Year
July 1, 1964, to June 30, 1965

Balance on hand July 1, 1964	$ 711.87
Receipts	6,574.30
	7,286.17
Disbursements	6,860.91
Balance June 30, 1965	$ 425.26

"NATIONAL MAPLE SYRUP DIGEST"

Number Mailed - October 1965 Issue:

New York - - - - - - - - - -	1,713
Vermont - - - - - - - - - - -	1,555
Pennsylvania - - - - - - - -	658
Michigan - - - - - - - - - -	506
Ohio - - - - - - - - - - - -	413
Wisconsin - - - - - - - - - -	395
New Hampshire - - - - - - - -	268
Minnesota - - - - - - - - - -	238
Indiana - - - - - - - - - - -	224
Massachusetts - - - - - - - -	211
Maine - - - - - - - - - - - -	201
Virginia - - - - - - - - - - -	59
West Virginia - - - - - - - -	48
Maryland - - - - - - - - - -	11
Iowa - - - - - - - - - - - -	11
Illinois - - - - - - - - - - -	6
Mixed States: Calif., Conn., Ky., N. Mex., N.J., N. Dak., Okla., Washington, D.C. - - - - - -	47
Advertisers - - - - - - - - -	63
Canada: Ont., Que., N.S. - - -	31
Total - 24 States and 3 Provinces -	6,658

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CONTRIBUTIONS

	Number	Dollars
Independent	410	977.50
Association	167	167.00
Total	577	1,144.50

CHAIRMAN: Edgar J. Lott

INTRODUCTORY REMARK ON THE MAPLE INDUSTRY IN INDIANA

By Edgar J. Lott, State Extension Forester, Purdue University, Lafayette, Ind.

I greatly appreciate the opportunity to extend greetings from the Hoosier State. Although we are not "on the map" as far as national maple sirup statistics are concerned, we do have quite a few (about 400) producers in the State, and some very good operations too. Also, and this is what interests us in extension work, we have a rather large concentration of sugar maple much of which is not being tapped at present. Therefore, our educational program has been: First, to bring new technology to our producers; secondly, to encourage new production in areas where sugar maple stands are not being utilized.

Just a word about some of our activities. In December we will have our fourth series of Maple Sirup Institutes and each year our attendance increases. In 1965 we completed a sound, full-color movie entitled "Collecting The Maple Bonus." This has received wide circulation and has been helpful in promoting interest in maple in Indiana. We are also at present conducting investigations on winter tapping and the length of the tapping season in southern Indiana. We have been active in assisting with an annual Maple Sirup Festival in the picturesque west central Indiana. This has been highly successful.

We are enjoying our work with the maple industry and I am sure that through cooperative effort we can look forward to a more efficient and progressive maple industry.

ECONOMICS OF MAPLE SIRUP MARKETING
(Summary)

By Reed D. Taylor and Jerome K. Pasto, Pennsylvania State University
University Park

Maple sirup producers have the option of selling their product as a semi-finished product to manufacturers for further processing, wholesaling it to retailers, or selling it direct to consumers. These three outlets can be classified as the wholesale market in drums, wholesale market in consumer packages, and the retail market. Each of these markets is unique in its set of market characteristics and in the problems it faces.

A survey of the maple sirup markets conducted by Pennsylvania State University showed that in 1963 the retail market (or direct sales to consumers) was the most used of the three markets and returned the highest prices. Eighty-seven percent of all producers used this market, selling 50 percent of the total product this way. The average price per gallon equivalent was $6.22. This price is a weighted average of sirup and confections sold in various types and sizes of packages. Product distributions according to sales outlet and prices received in this market were: Own home or sugarhouse, 71 percent at $6.09 per gallon equivalent; own roadside stand, 4 percent at $8.17 per gallon equivalent; home delivery to consumers, 13 percent at $6.05 per gallon equivalent; mail order, 9 percent at $6.55 per gallon equivalent; and miscellaneous, 3 percent at $6.76 per gallon equivalent. The individual producer has his greatest influence in this market. He determines the price to be charged subject to the influence of neighboring producers and the customer decides if and how much she wants to purchase. Factors such as producer personality, producer and sugarhouse cleanliness, location, package type and size, advertising, time of sales, and product quality are very important in this market.

The wholesale market in consumer packages was the least used by maple producers. Twenty-one percent of all producers sold 13 percent of the total product in this market. Average price for all sirup sold in this market was $5.91 per gallon equivalent. Product distribution according to sales outlet and prices received in this market were: Other maple producers, 8 percent at $5.49 per gallon equivalent; roadside stands or shops, 27 percent at $6.17 per gallon equivalent; retail stores, 42 percent at $5.86 per gallon equivalent; hotels, motels, or restaurants, 10 percent at $5.71 per gallon equivalent; and miscellaneous, 13 percent at $5.94 per gallon equivalent. The producer has less influence in determining price in the consumer package wholesale market than in the retail market. Prices are sometimes set by the producer, sometimes by the buyer, and often by bargaining between the two. While this market now accommodates a small share of the total sirup sold, its importance and market share will grow as production units increase in size and marketing procedures improve.

Wholesale sales in drums resemble usual agricultural markets with the product passing through several hands and processing procedures before reaching the ultimate consumer. In 1963, 60 percent of all maple producers sold some sirup on this market. These sales were 37 percent of the total product sold. Sales distribution and prices received according to grade were: Fancy grade, 29 percent of drum sales at an average price of $3.77 per gallon equivalent; A grade, 25 percent of drum sales at $3.30 per gallon equivalent; B grade, 27 percent of drum sales at $2.72 per gallon equivalent; and C grade, 19 percent of drum sales at $2.59 per gallon equivalent. The average price received by all producers in this market was $3.15 per gallon equivalent.

The United States and Canadian maple sirup industries are highly interrelated. Most large United States processors buy in both the United States and Canada. Canadian

companies sell sugar and sirup to United States blenders. The production areas border each other. Efficiency in production and marketing, along with research projects, economic levels, producer organizations, production trends, government programs, transportation costs, tariffs, monetary manipulations, etc. of each country have direct bearing on the other.

The market for drum sirup in Canada and the United States is particularly interrelated. Prices are determined by demand and supply factors in both countries. Individual producers have little control in the determination of price. Group action can, however, often be effective within competitive ranges.

The ability of a producer to develop and properly use alternative markets largely will determine his future profits as a maple sirup producer. Good marketing procedures are every bit as important as good producing procedures.

CORNELL'S EXPANDED MAPLE PROGRAM

By Robert R. Morrow, Department of Conservation, Cornell University
Ithaca, N. Y.

Maple research was begun at Cornell's Arnot Forest in 1950 and a sugarhouse was built in 1956. In the 9 succeeding years, research was greatly expanded and the whole operation has been open to the public as a demonstration of changing techniques in a rapidly changing industry. The principal changes made at Arnot Forest follow:

(1) Conversion from buckets to 90 percent tubing--not only has tubing taken much of the hardest work out of sugaring, but previously inaccessible trees are now reached; also extremely deep snow is less of an impedance.

(2) Conversion from gravity flow to vacuum pumping for two-thirds of the tubing--with our variable slopes, we have found that vacuum pumping increased sap flow 10 to 20 percent in 4 of the last 6 years. The value of this additional sap greatly exceeds costs.

(3) Use of paraformaldehyde pellets, which have increased sirup quality, together with use of tubing, permits early tapping to obtain the good flows that occasionally occur in February or even earlier.

(4) Conversion to oil and addition of covered evaporator, gas finishing pan, running water, and electricity all have contributed to the efficiency and cleanliness of operation.

(5) Addition of new trees made available by intensive thinning in a young maple stand. Sugar maple is one of our fastest growing trees if located on reasonably productive soil and properly thinned. We have increased the diameter of young trees 3 to 4 inches in a decade.

In less than a decade of operation at Arnot Forest, the number of tapped trees has nearly doubled, production per taphole has increased by nearly a quarter, sirup quality has increased by at least a third, labor per taphole has been halved, and wages per hour have been nearly doubled. In the last 2 years, most of the sirup was light amber and less than 5 percent graded below medium amber. In both years production per taphole was just under 0.4 gallon sirup--and this from mostly small trees which average only 2 percent sap. In addition to technological change, however, much credit must be given to Alfred Fontana, our Resident Manager, who takes pride in the cleanliness and the rapid handling necessary for top quality sirup and who knows the need for such mundane things as uncovering tubing with frozen sap upon anticipation of a new run.

The year 1965 marks the beginning of a greatly expanded program of maple research and demonstration in New York. Mr. and Mrs. Henry Uihlein of Heaven Hill Farm at Lake Placid leased their sugarbush to Cornell for a 10-year period and most generously provided us with funds to build and equip a new sugarhouse capable of producing a thousand gallons of sirup annually. The College of Agriculture then provided sufficient funds to employ a full-time Resident Manager, Lewis Staats. Mr. Staats comes to us from the U. S. Forest Service with the kind of training and experience which will allow him to carry out forest experiments and demonstrate new techniques and knowledge as applied to the maple sirup industry.

The Uihlein-Cornell Maple Syrup Project, as this new project is called, has the following purposes:

(1) To develop economic and efficient maple production methods for Adirondack conditions.

(2) To study market methods suitable for northern New York.

(3) To conduct an extension program in maple production and marketing.

The sugarbush is far different from the one at Arnot Forest and comparison of results from the two sugarbushes will help gain new knowledge of maple sap flow and sirup production. The Uihlein bush is possibly the highest and certainly one of the coldest in the State. It lies between 2,000 and 2,500 feet above sea level, while the Arnot bush is at one-half this elevation. Very deep, lasting snows may limit woods work. Since the Uihlein bush is much larger (5,000 vs. 1,200 tapholes), has sweeter trees, but also has lower sap production per taphole and more sugar sand, interesting cost comparisons can be made. Finally the variety in age classes and species composition in the Uihlein bush will permit setting up experiments and demonstrations of thinning, timber stand improvement, and reproduction of sugarbushes.

Because of the need to develop markets and to demonstrate new methods we located the new sugarhouse on the main road, even though the nearest maple trees are over a quarter mile distant and separated by rough and swampy ground. The sap from 3,000 tapholes, some over a mile away, will be collected by gravity in one network of tubing and finally delivered through 1-1/4-inch plastic pipe. All trees are painted so that the number of dots indicates number of tapholes, color indicates tubing line, and placing on the tree helps to indicate direction of line. The number of tapholes is determined by tree size and growth rate, rather than by the old rule of thumb which only considers tree size. Present roads will be improved so that visitors can drive into the bush during the summer months to see the sugarbush management at first hand.

The sugarhouse is 60' x 24' and can be expanded at one end. It features pole construction, rough wood finish, and a roof supported by trusses spaced 12 feet apart. Because we want realistic cost figures that can be duplicated by others, only semiskilled labor, similar to that available on many farms, is employed. The sugarhouse will contain an office, storage and salesroom, and two restrooms. It will have three evaporators in series which will produce about 10 gallons of sirup per hour. The best automatic drawoff and filtering and canning aids are planned to allow one man to do most of the work.

In the area of marketing, our immediate plans call for exploring the possibility of making the sugarhouse into a combined tourist and educational attraction for customers. Only high-quality sirup will be sold; the best regional price will be asked. We will aim for thicker sirup, about 66.5° Brix--both because of the better taste and to offset any tendency for the buyer to associate light color sirup with thin sirup. We have already made an individual label which features (1) "Maple Syrup" in large print, (2) an interesting and individual engraving, (3) "Pure Adirondack" for regional promotion, and (4) "Lake Placid" making the package a souvenir.

Both the Arnot Forest and Lake Placid facilities are open to the public throughout the year. Because the resident managers have other duties, it is best to let them know of impending visits in advance. Addresses are: Alfred Fontana, Arnot Forest, Van Etten, N.Y.; Lewis Staats, 35 Averyville Road, Lake Placid, N.Y.; and Lake Placid sugarhouse located on Bear Cub Road.

ROUNDTABLE PANEL DISCUSSION ON FALL TAPPING

Moderator: Albert G. Snow, Jr.

Moderator: Mr. Chairman, when thinking over what would be appropriate as opening remarks for the roundtable on fall tapping of sugar maple trees, I was reminded of an old saying: "How much wood could a woodchuck chuck if a woodchuck could chuck wood?" Similarly: "How much sap can a sugar maple give if a sugar maple could give sap?" Though the answer is not a simple one, those present on the platform in this roundtable will help to give you some insight into how much sap a sugar maple can give.

The results and comments of this group had a formal beginning at the Fifth Maple Conference held here in 1962, when Mr. N. E. Beabes reported on his results with fall tapping. His talk generated a lot of interest; and Dr. Willits and his staff were frequently asked later whether fall tapping really was worthwhile.

To obtain at least a partial answer to this question, Dr. Willits, during the summer of 1964, arranged a collaborative study on fall tapping. From Maine to Minnesota 12 producers in 9 states participated in this study, with actual data obtained from 9 of them.

The general methods for the study were to put up from 25 to 50 taps in the fall after the leaves were gone; there had been a hard frost. Taps were drilled 3 inches deep, and PF pellet freshly inserted every month. Records of sap volume, Brix, and temperatures were kept for each run.

The data were sent to Dr. Willits of this Laboratory. Lab statistician, Joe Boyd prepared a summary of the results, copies of which were sent to each collaborator.

The average yield obtained per taphole by all collaborators from October to April was 3 quarts in October, diminished to near zero in November, then increased to 5 quarts for December, January, and February. The maximum yield of 20 quarts was in March, this diminishing to less than 3 quarts in April.

The average degrees Brix of the sap from November to March remained almost constant at 2°. During April the degrees Brix of the sap rose steadily to 2.75°. So that the data of sap yields would reflect the ecological factors in the different maple areas the data of collaborators in the same general areas were pooled.

The sap yield data for New England is pooled data of Lesure, Mass., Bascom, N.H. Marvin, Vt., and the Northeast Foresty Station, Burlington, Vt. This slide shows that there was a fairly uniform yield of 2-1/2 quarts of sap per taphole from October to January when it dropped to zero, then gradually increased to a maximum of 5 quarts per taphole during the latter part of February.

The yield data for the Appalachia region is the pooled data of Beabes, Pa., and Smith, N.Y. They had no sap flows until early in December when 2 quarts were obtained per taphole, with progressively larger yields in February, March, and early April with 20 quarts per tap obtained in March.

The pooled data of Mills, Ind., and of the University of Indiana, Ind., represents the central area. The sap flows there started in late November with the maximum flows of 18 quarts per tap occurring in late December and early January, diminishing to 2 quarts by mid-March with complete stoppage of the fall taps by late March. The yield in March from newly drilled holes (control) yielded up to 48 quarts per taphole.

The data of Reynolds, Wis., the only collaborator representing that area, showed little or no flow until the middle of March and only very little then.

At the Burlington Center, Northeastern Forest Experiment Station, Burlington, Vt., Dr. Koelling used 80 taps in these experiments. These were distributed in bushes having exposures facing the four cardinal compass points with bushes on different slopes; one on the east slope, another one on the south slope, another on the west slope, and another one on the north facing slope. The tapping places were on the south, west, east, and north of the trees. The average sap yield per taphole in quarts for the period November 1 to February 1 was about 14 quarts from the trees on the east side of the hill; about 12-1/2 quarts from the trees on the south slope, with little over 7 quarts for those on the west slope; and from those trees on the slope facing north, as you would expect, there were only 5 quarts of sap produced.

These data should not be taken as absolute or typical because they represent only 1 year's observations of a very atypical year, so far as maple sap flow is concerned. In Wisconsin the cold weather set in early in the fall and continued up to and through the "normal" sap season and the results were no crop. In Appalachia and in New England areas the drought was so severe during the summer and fall of 1964 that the scarcity of ground water no doubt was reflected in the low sap yields.

I would now like to turn to our roundtable panel, all of whom participated in these studies, for comments. The panel members are from left to right: N. E. Beabes, a producer of southwestern Pennsylvania; Adin Reynolds, Reynolds Sugar Bush, Aniwa, Wis.; Lloyd Sipple, J. R. Sipple and Son, Bainbridge, N.Y.; Xura Smith, producer, western New York; Fred Laing, University of Vermont; Robert Coombs, Coombs Maple Products, southern Vermont; Linwood Lesure, producer, northwestern Massachusetts; James Marvin, University of Vermont, northern Vermont; and myself of the Northeastern Forest Experiment Station, Burlington, Vt.

Moderator: I understand some interesting observations have been made relative to the germicidal pellets.

Lesure: At the end of 4 weeks most of the pellet was still intact.

Moderator: Do you think this is due to small sap flow?

Smith: Yes, with little sap flow there wasn't any of the pellet used up.

Beabes: I put only one pellet in at time of tapping 600 holes and didn't replace any because they remained intact up to the time of the normal sap season; so, just let them alone. These holes produced a full crop during the sap season.

Moderator: Did the taphole dry out?

Beabes: No, not according to my experience.

Moderator: Did any of you gentlemen observe anything different in regard to the pellet? Do you feel that the amount of sap obtained prior to the normal season would make a fall-winter operation worthwhile?

Sipple: With the 5 quarts obtained over the 3-month period it is doubtful. The figure of 5 quarts is only an average one; it could vary and, therefore, be much larger in some woods. In my case, because of low-ground moisture and dehydrated trees, we did not

obtain any sap. Another year this could be quite a different story. This was also true of Lesure's situation because they were in one of the driest areas on record.

Reynolds: We didn't get any fall-winter sap, not because of low-ground moisture, but because of the low temperatures.

Sipple: We tapped the first of December. All through December we had what should be good sap weather but none flowed. About Christmastime we had heavy rains and between Christmas and New Years we had two good runs.

Lesure: We kept temperature records, making readings at 6 a.m. and at 12 noon. Our records do not look like those averages shown today. We didn't have any sap yield until mid-December when we had weather that provided some freezing nights. I would like to add that my wife cooked down every bit of sap to sirup, and we brought samples along. The first ones, obtained in November, were peculiar. While light in color, it tasted like green leaves. This green-leaf flavor disappeared in the samples obtained in January and the maple flavor was much improved.

Moderator: Would you say Jim (Marvin) that there was something in the early run sap, similar to that which causes the buddy sap flavor in late run sap?

Marvin: I don't know. One of the problems that Fred (Laing) and I have been discussing is the effect of fall- and winter-produced sap on the flavor and color of the obtained sirup. We did't boil any of our sap to sirup so I would be interested to learn of the experiences of those here who did boil down their sap.

Beabes: I have collected fall and winter runs of sap for 3 or 4 years. The sirup we made from the early flows of sap was sent to Dr. Willits and to Ed Farrand (our Extension Forester). Both rated the sirup to have good flavor. I, therefore, feel that the early runs of sap (fall and winter) produced my best sirup.

Smith: I fall-tapped and made sirup. This was of excellent flavor, better than that obtained at the beginning of the regular spring sap season.

Bascom: I didn't make any sirup from the sap we obtained in our tapping experiments. However, I made some interesting observations which I would like to mention. We observed sap flows December 10, early in January, and again the middle of February. Due to lack of help we did not have time to make further observations. In my case, perhaps due to our elevation (1,400 feet) and the western exposure of the orchard, the sap was frozen up most of the time so that the collection of sap, even though it ran, would be difficult and impractical.

Moderator: Ken (Bascom), the trees you tapped in the fall--did they flow during the spring sap season?

Bascom: That is one thing that I want to mention. What surprised me more than anything else was that these fall-tapped holes, for some reason, seemed to outproduce other tapholes drilled at the beginning of the normal season (last week of February) in surrounding trees. I don't have any explanation of this. Like Beabes, I did not have to replace any pellets. Each time I inspected the taphole the original pellet was still there and apparently unchanged. In fact, these trees continued to produce sap until about the first of May.

I have drawn one very important conclusion from this--there is no such thing as tapping too early so far as I am concerned.

Moderator: That is a very important conclusion, I think, that would come out of this study. If every producer could appreciate that he doesn't have to wait until just before the first run of the year, instead he can tap at an earlier date, when labor is available, when his time is available, and the weather is nice, and he can get around in the woods. He can go out there in January, perhaps, and put those taps in when the conditions are just right and put a pellet in there--he can always do that.

Lesure: Up in our area in Massachusetts, January, while cold, is a lot better for tapping trees and putting out the collecting equipment than February, because February is the snow month. For the past 3 years we have tapped in January and have had cold but fair weather.

Sipple: I have wondered if pellets in fall tapping would last up to and throughout the regular spring season. The cold weather this year was not favorable to bacterial growth, which may explain why the pellets lasted longer. We made periodic counts of the bacteria in our sap and found these all to be low. In years favorable to bacterial growth the pellets may not last so long. In any case, we tapped the first of December and then replaced pellets the first of March. At this time, 3 months later, there were still some of the original pellet remaining in the taphole and we replaced them at this time.

Snow: That raises a question. Can you put too many pellets in a taphole or replace them too often? Would this cause objections from the standpoint of the pure food laws? Dr. Willits, perhaps you have the answer.

Willits: The use of the pellets in maple tree tapholes is acceptable to the Food and Drug Administration, providing the amount of formaldehyde in the sirup made from sap obtained from holes containing the germicidal pellets does not have a residual concentration exceeding 2 p.p.m. On the basis of the experimental work done at Michigan State University, the only way to insure this is not to have more than 1 pellet per taphole at any one time. To replace a pellet or part of a pellet with a whole one would be O.K. providing the old pellet or its remaining part be removed before inserting the new one.

Laing: Is there any reason why the pellet should lose its effectiveness when half used?

Willit: No. The pellet's purpose is to keep the bit of sap remaining in the taphole between flows sterile; even a few particles of the pellet is sufficient to saturate the small amount of sap and keep it sterile.

Moderator: Fred (Laing), what is the elevation of the University of Vermont maple sugar farm at Underhill?

Laing: 1,200 feet.

Moderator: Did you have conditions favorable for fall runs?

Laing: Yes, we had sap flows about October 26. This was after the leaves had dropped. When we tapped while the leaves were still on the trees we got nothing. The flow on October 26 was following a good frost. We did not tap in December because it was below freezing and obtained no sap until February. One tree where the hole was left without a pellet produced sap halfway through the spring sap season.

The Brix of the sap changed noticeably from fall to spring. In the fall the average was only 1.45° Brix and raised to 2.65° in the spring. This may reflect ground moisture. With greater moisture in the ground in the fall, the results may be different and may explain

why, in some areas, fall tapping produced good runs with the Brix of the sap as high as it is in the spring.

Marvin: I was quite surprised at the results that Laing and I obtained at our Underhill Experimental Farm. We have known for a long time that sugar concentration in the trees that produced sap between fall and January is low and should produce sap of low Brix. That is what we obtained. In November we had 9-1/2 hours of daylight and 9 hours in December as compared to the 12 hours of daylight in the spring sap season, which is close to the equinox. Based upon this, I had expected we would not get much sap from the fall tapping; however, we actually obtained 24 quarts per taphole, which compares favorably with the 34 quarts obtained per hole in the spring flow. Of course, it was of low Brix and, therefore, produced much less sirup per taphole.

Moderator: This apparently agrees with Mr. Beabes' results.

Beabes: Yes, I obtained my best runs in December.

Smith: I am curious to know if others found fall tapping just as productive as spring tapping.

Moderator: Mel Koelling, who conducted our (F.S.) experiments in Vermont, ran some controls. Will you tell us about these, Mel?

Koelling: We found the volume in sap yield up 40 percent as a result of fall tapping. The spring yield was down. The Brix of the spring runs was way up and did not appear to be effected by the fall tapping.

From Floor: What is the effect on the tree when keeping the taphole open for this long period of time?

Beabes: I have had as much experience as anyone. I would say it is too soon to tell what effect it has on the trees, although in my particular case with 600 trees, I can see no difference. The trees that were tapped are just as good as the trees standing beside them that were not tapped. Many of these were never tapped; I see no difference. As time goes on there may be a difference.

From Floor: Do the holes seal up all right?

Beabes: Oh yes, the same as they do in spring tapping. However, I do think that the pellets keep sap flowing later in the season. At my place, for instance, I have had sap flows in May. The least bit of weather suitable for sap flow seems to produce flow in tapholes containing pellets. The pellets sure seem to keep the tapholes open; but whether they effect the tree in any way I cannot say.

Moderator: Let's turn to the back of the room to Bob Morrow.

Morrow: A few years ago we did some early tapping (during January). This was in the days before the pellet. The product was definitely poor late in the season, presumedly due to the increased bacterial action in the early tapped trees. I also have a report here about trees tapped in November--the Brix of the sap was only 0.5° to 1.0°. Also, Stevens at the University of New Hampshire in the 1930's tapped trees in the fall and found the sap to be low in sugar.

Moderator: We are glad to have these confirming reports, Bob. If there are no more

questions, I believe we have further program material coming up. Does the panel have anything more they would like to say?

Bascom: I have been wanting to direct a question to Mr. Beabes. It interests me that he has been fall tapping for several years, apparently, on almost a commercial scale. Is this a commercial venture?

Beabes: Absolutely! I have doubled my production relative to my neighbors by fall tapping.

Bascom: You are located where the temperature is such that you have freezing and thawing in late fall and during the winter?

Beabes: We are at an elevation of 2,000 ft. and have frequent thaws, about every week or 10 days.

Bascom: My conclusion is that I am located at too high an elevation or too far north, or both, for fall tapping ever to be practical for me. I wonder if the other panel members feel this way.

Sipple: I think these factors are significant. Mr. Beabes does have a high elevation but he lives in southern Pennsylvania. There is quite a lot of snow down there, but I don't think the average temperature is as low as it is in northern New England.

Moderator: I heard a comment from another person who lived in West Virginia and they said that temperature conditions down there are ideal for January tapping.

Reynolds: Would this 1 year be anywhere near conclusive? Our results were almost nil. We did some fall tapping again this year and we have some bags on trees with more sap in them already than we collected all last fall. So the results are going to be different for the coming year.

Moderator: Certainly 1 year can't prove anything. I believe fall tapping experiments should continue. I don't think our interest has been satisfied with one roundtable on this one test.

CHAIRMAN: Roy E. Skog

INTRODUCTORY REMARKS ON MICHIGAN'S MAPLE SIRUP INDUSTRY

By Roy E. Skog, Extension Specialist (Forestry), Michigan State University, Marquette

Michigan has recently ranked from fourth to sixth among the leading maple sirup producing States. In 1964 Michigan ranked fifth with a total production of 96, 000 gallons of sirup.

Michigan has the potential to greatly expand its maple industry. It has approximately 3. 0 million acres of small sawlog and pole-size northern hardwood stands in which sugar maple is the predominant tree. Maple trees in these stands are now reaching tapping size. If only 1 percent of the 3. 0 million acres were developed for maple production, the present level of production would be about tripled. Michigan also has a big and growing tourist trade, which can provide good market outlets for maple products.

Now I'd like to comment on some recent maple production trends and developments in Michigan. Up until about 1958 maple production in Michigan was on the decline, but now it appears to have leveled off at around 80, 000 to 100, 000 gallons of sirup per year. Actually our production may be going up slightly. We now have one large central evaporating plant in operation,at least two under consideration, and quite a few producers who are buying sap to increase their production. Some modernization of facilities is also taking place. Recently throughout the State a number of new sugarhouses have been built. Most of these have concrete floors, electricity, running water, and modern equipment. The use of oil for fuel and covered evaporators are also coming into use. However, most of our operations are still of the older type and need modernization.

In closing, I'd like to list some of the things I believe we in Michigan need to do, if we are to capitalize on our maple products potential:

1. Modernize facilities and improve efficiency.

2. Create larger production units and incorporate sound business management.

3. Develop a marketing program for selling to the tourist trade.

4. Bring into production more young and vigorous maple stands.

5. Form a State association of producers to speak for and assist the industry.

There are many problems involved in carrying out a program as outlined above. Answers to many of these will have to come from development and research of the kind being done here at this Laboratory.

THE CURRENT MAPLE RESEARCH PROGRAM AT THE UNIVERSITY OF VERMONT

By James W. Marvin, University of Vermont, Burlington

It seems worthwhile to review some of our previous work and the conclusions from it, as well as to present some new results since the last conference.

One of the most important new developments in the maple industry has been the wide use of plastic tubing for gathering maple sap. Over the last 10 years we have compared the yield from plastic tubing with that from buckets and also compared the various ways of using plastic tubing with each other. Some of these trials have been repeated for 3 years to evaluate seasonal effects.

We conclude that tubing systems may (depending on how they are installed) outyield metal spouts and buckets. The principal reasons are that plastic spouts thaw before metal spouts under metal bucket covers, and airborne infection is reduced with use of plastic tubing. Two very important factors influence the yield from tubing "systems" regardless of the "system" used.

1. Appreciable volumes of sap come from what we have called "weeping" flows. There is only a very slight stem pressure under these conditions and any back-pressure in the taphole reduces the flow.

2. The effect of reabsorption--when a taphole stops flowing it will reabsorb if supplied with sap from the tube.

In an experiment comparing vented with unvented systems the unvented system yielded much more sap than the vented--about a 50 percent increase for each of the 2 years.

Tapholes treated with PFA pellets or with a sodium hypochlorite solution gave much greater yields than untreated tapholes.

Suspended and ground system did not show significant differences in yield. Experiments comparing the yield from gravity flow systems with vacuum pumped systems demonstrated that under an ideal situation a gravity system yields as much as a vacuum system. Where the terrain is flat and conditions are not ideal for a gravity system, vacuum pumping increases yields.

In our experience excellent quality sirup has been made from our tubing system. Most of the equipment is nearly 10 years old. For the past 3 years we have made an average of 290 gallons of sirup, 84 percent fancy or light amber, 12 percent A or medium amber, and 4 percent B or dark amber.

Three years ago we gave a progress report on our study of a possible correlation between the sugar concentration and volume yields for a group of selected trees for a 15-year period. A positive correlation between these two factors would be of great value in a tree-selection program. The results are inconclusive because for some trees and for some years the sugar concentration and volume yield are correlated; but in other years they do not. This may be due to the fact that sugar concentration depends in part on the growth condition the previous summer, while volume yield is a function of the weather during the sap season.

The field selection of high yielding young trees (2 to 5 inches in diameter) from natural stands is an important problem in a program to develop new stands of high yielding maple trees. An extensive program of testing young trees was begun in 1963. It was found that the sugar concentration of the sap of young trees showed much greater day-to-day and season-to-season variation for individual trees than is found in mature trees. This great variation would seem to preclude an easy grouping of the trees in a population on the basis of the sugar content of the sap.

Our tree physiology studies recently have been concerned with the direction of sap movement in the tree and the pressures responsible for the movement.

One simple method to demonstrate the direction and extent of movement is to allow the tree to absorb a dye solution through a taphole. As much as 2 quarts of dye solution may be absorbed and move either up or down the stem as much as 20 feet. The direction and extent of the movement is influenced by the temperature regime during the experiment.

More elaborate experiments have been conducted to evaluate the relative roles of root and stem pressures and flows to taphole yields. It has been known for 60 years or more that the greatest yields come from tapholes at the usual height. The flows from holes higher on the tree and from roots are smaller. What factors are responsible for these differences? Pressures and temperatures were measured 30 feet up in the crown, at normal tapping height, in the root near the base of the tree and 7 feet from the stem. In addition to this data from intact trees, data were also recorded from a tree whose crown was removed 20 feet above the ground and from a stump. The cut surfaces were sealed to prevent sap from flowing from the cut.

The results indicate that early in the sap-flow season when the soil is frozen or under snow cover, the sap flows down from the crown from the twigs and branches to the taphole. Later in the season apparently root pressures force some sap up to the taphole.

The important finding is that the most rapid rates of flow occur when both root and stem pressures occur at the same time. This explains the big flows in northern Vermont in early April.

Quite recently we have begun a new program to study the biochemistry of carbohydrate interconversion in the maple tree as influenced by seasonal temperatures in nature. We will also study the same systems using maple tissue cultures grown under controlled conditions in the laboratory.

THE ROLE OF THE COOPERATIVE EXTENSION SERVICE IN REVITALIZATION OF AN OVERLOOKED NATURAL RESOURCE

By William F. Cowan, Jr., Extension Forester, The Ohio State University, Columbus

The primary aim of the Cooperative Extension Service, as stated in the Smith-Lever Act of 1914, is "to aid in diffusing, among people of the United States, useful and practical information on subjects relating to agriculture and home economics and to encourage application of the same."

This act provided the framework for Extension forestry programs. However, The Ohio State University College of Agriculture did not take action at that time to provide for forestry specialists. In 1917, Ohio produced over 1,000,000 gallons of maple sirup equivalent.

In 1924, Congress passed forestry legislation known as the Clarke-McNary Act. Section 5 of the Act provides for educational assistance to owners of farms "in establishing, renewing, protecting, and managing wood lots, shelter belts, wind breaks, and other valuable forest growth, and in harvesting, utilizing and marketing the products, thereof."

On September 15, 1925, Forest W. Dean was appointed as the first Extension Forester in Ohio. In 1925, Ohio produced 307,000 gallons of maple sirup equivalent, and had a 4-year average production equivalent of over 400,000 gallons. This was a drop of approximately 600,000 gallons in a period of 8 years. At this rate of production decrease Ohio would have ceased to be a maple producing State by the early thirties. Fortunately this did not occur. We have remained a major maple producing State and had a production of 108,000 gallons in 1965.

The Cooperative Extension Service is the educational arm of the United States Department of Agriculture and functions through the land grant universities--in our case, through the College of Agriculture and Home Economics of the Ohio State University. Cooperative Extension work functions on Federal, State, area, and county levels through a system of Federal specialists, State specialists, area agents, and county agents.

Cooperative extension has only one commodity to offer and that is information based on research findings. It has only one function. That is education.

Naturally, Ohio must deal with its own problems. The Ohio Cooperative Extension Service is a reflection--if we are doing our job well--of what is happening in our own State. It is not my purpose to compare our program with those in other states. Our methods and programs might not fit your conditions. I am only here to explain what we have done and why we have done it.

Ohio is a complex State. It is a leading industrial and agricultural State with a land area of 26,000,000 acres and a population of about 10.3 million people. Our forest land base is approximately 5 million acres, or about 20 percent of the total land area. Sixty percent of our forest land is located in the so-called Hill Country of Ohio, southern and eastern Ohio. Our main center of maple production is in northeastern Ohio and is surrounded by Cleveland, Canton, and Akron.

It is important to note that our main producing areas, which produce over two-thirds of our total crop, are located within an area which is rapidly becoming more industrialized and urbanized. The remainder of our production is scattered over north-central, central, and southwestern Ohio. As is the case in other States, we have a large number of sugar maples that are not being utilized.

In 1959, the present extension forester was appointed to the Cooperative Extension staff with responsibility for technical educational work in maple products. During the 1960 Geauga County maple school, the specialist had the opportunity of extended discussion with C. O. Willits about the existing Ohio educational program and the potential of the Ohio maple industry.

In extension work, educational programs are based on where the producers are in their adoption and application of research findings to production and where they might be if all the available research results had been accepted and applied. The basic problem is to inform the producers about the latest research findings and encourage them to apply the results of research to their own operations.

This is the basic job of Extension--to take the research results to producers and to processors.

After the discussions with Dr. Willits, the extension forester visited every sugar camp that he could and talked with sirup producers in many parts of the State. The results of this informal survey indicated that there were many levels of technical proficiency across the State varying from a high level in northeastern Ohio to a low level as shown by the continued use of wooden buckets and kettles in other sections of the State. Many producers were not aware of research findings which at that very moment were causing a major revolution in production methods.

Further investigation revealed the reason why northeastern Ohio was so much further advanced than the rest of the State. As far as can be determined, two major programs had contributed heavily.

(1) Geauga County Maple Festival. This festival was conceived by A. B. Carlson, a Chardon hardware dealer, who was disturbed by the fact that most of the sirup was being shipped in bulk to Vermont at wholesale prices. He promoted the idea of the first Maple Festival in 1926. Today, this festival attracts nearly 500, 000 people and results in the sale of some 4, 000 gallons of maple sirup.

Public attention throughout Ohio is focused on maple products during this annual event at Chardon, Ohio.

(2) Geauga County Annual Forestry and Maple Syrup Institute which presented its 25th annual educational program in January 1965. This annual institute was started in the late 1930's by County Extension Agent, Charles Haas, and has continued to the present time under the direction of County Extension Agent, Leland Schuler. Programs for the institute are determined by a local committee of maple producers with the advice and cooperation of Mr. Ture Johnson, Farm Forester with the Ohio Division of Forestry and Reclamation. This institute annually attracts over 300 producers from distances up to 100 or more miles and may have the largest producer attendance of any single maple school held in the United States. It has had an enormous influence on production practices in northeastern Ohio.

Outside of northeastern Ohio, the maple resource was present but had never been given the attention it rightfully deserved. The situation in 1959 looked like this:

1. Approximately 1, 000 producers with many small, marginal operations.

2. Production centered in northeast Ohio, accounting for 66 percent of total production.

3. No effective extension program on a Statewide basis. Geauga County doing an outstanding job of education.

4. Older producers were dropping out with no younger producers entering production.

5. A new forestry specialist who knew little about maple processing technology.

An honest appraisal indicated that the maple industry was declining in importance in areas of the State where it had significant potential to contribute to income. It was obvious that major production centers in northeastern Ohio would probably decline in importance, over a long period of time, owing to heavy pressures for additional land from urbanization and industrialization. As a result of this pressure, production would have to be stimulated in other areas of the State if the maple industry was to remain strong and stable.

Needs were very obvious but it was impossible to move rapidly in setting up a Statewide program because of the necessity for the extension specialist to learn the technology; to find out who the key producers were and what the major production problems were; and to determine the extent of interest on the part of County extension staff in carrying on an expanded program.

This program took approximately 3 years of contacting producers, dealers, and agents but the result was very revealing. There was an abundance of latent interest.

In 1963, a series of three area maple schools was initiated with each school serving 4 to 10 counties. One of these schools was held in southern Ohio where we had trees but <u>no</u> producers. In 1964, we went to four area schools plus the Geauga Institute. In 1965, there were five area schools plus the Geauga Institute. In 1966, we will probably have at least nine area schools and are thinking about a 2-day in-depth school on the chemistry of maple sap and sirup. This school will probably be held in the Geauga County area. If it is successful, it will be duplicated in other parts of the State.

In addition to the schools, the extension specialist spends as much time as possible in actual field work with the producers. Excellent cooperation has been extended from the Ohio Department of Agriculture through their Division of Foods, Dairies, and Drugs. In fact, one of their supervisors and the extension specialist now serve as judges of maple products at the Geauga County Maple Institute. This program has also had outstanding support from the Farm Foresters of the Ohio Division of Foresty and Reclamation.

We feel that our efforts have been very rewarding. The personal satisfactions gained from working closely with such fine people have been exceptionally stimulating. We feel that we have barely scratched the surface of the total program possibilities.

We intend to intesify our efforts in maple.

MAPLE CROP REPORTING

By Burton C. Buell, Division of Marketing, New York State Department of Agriculture and Markets, Ithaca

It's a pleasure to be here at the Maple Industry Conference again and I appreciate being asked to participate in this worthwhile endeavor.

I have been requested to talk to you about maple crop reporting on both the State and regional levels. I am more familiar with State crop reporting than the regional aspect and more familiar with New York State than other States. I will, therefore, concentrate my remarks primarily on the New York State procedure and touch lightly on the others as they fit in with the overall picture.

At the outset I must tell you that maple crop reporting is not in the true sense "crop reporting" as we understand it in comparison to most other commodities such as fruits, vegetables, Christmas trees, or meat.

The primary factor that makes maple reporting different from the others is that we cannot forecast production or intentions of producers. We are unable to do this because we do not know what the weather is going to be and as is readily understood, weather is the governing factor in the maple industry.

Therefore, in maple crop reporting we confine our information to the actual facts as they take place and the only forecasting done is purely a "guesstimate." Nevertheless, some of these "guesstimates" are fairly accurate, when all factors of the current situation are studied and compared with past years. In the last analysis it is nothing more than a guess and it should be so regarded.

To get back to the basic reporting, I must digress awhile to give you a little background on how maple reporting came about in New York State.

The U.S. Department of Agriculture has been making after-season summary reports for many years. However, in 1949 when we were requested to furnish more detailed and localized information on the industry prior to and during the production season, we had no pattern to follow as there were no reports of this kind available. This made it necessary for us to actually set up a format for a report and to find methods of obtaining information. To do this we contacted the county agents in maple producing counties, who helped us compile a list of producers.

We then visited the producers whom we had selected for the trial project. We explained the purpose of the report and the kind of information we were after, as well as the method we were going to use to obtain the information. From this trial group of cooperators we received information by questionnaire on the number of trees tapped, production as it progressed, and the sugar content of sap. There were also questions on demand, quality, prices, and methods of production. After the "information gathering" machinery was set up, we prepared the report and returned it in the completed form to the producers. In the beginning this was a small operation and a rather crude one to say the least. However, since that time changes in the questionnaire and methods of dissemination have been made.

We now have about 600 producers cooperating and the report is mailed to over 1,000 interested parties, including several offices of the Federal government, in both the United States and Canada, colleges of agriculture in 10 States, banks interested in farm loans,

county agents, eight State Departments of Agriculture, chain stores and other buyers and producers.

The content of the report has been improved and expanded to include seasonal conditions during the reporting period, the situation as it develops in other producing areas, as well as current production and prices received compared to the previous year. Also covered are sugar content of sap, prevalence of "sugarsand," demand in the various areas, quality comparisons, number of taps being used, production per taphole, information on pellets and plastic tubing, production methods, and comments of producers. This last item may not have too much statistical value, but it has considerable appeal to producers who are always interested in the feelings and problems of their fellow members. Questionnaire information is now supplemented by personal contact and phone contact.

So much for the report itself; now as to the value of this information. It is hard to figure a dollar and cents evaluation for a project of this sort. Therefore, we have to appraise its worth by the increased requests for the report and the types of persons requesting it. For example, it must have some value in farm loan and farm credit procedures because several of these sources have shown an interest in the report.

Various government agencies in the U. S. and Canada evidently find the information valuable as do the various State colleges of Agriculture. Producers make use of the price information and probably the supply and demand information. Producers also expressed an interest in how others are doing. As for the State Department of Agriculture and Markets, we have accumulated considerable information which enables us to study trends, check the advancement of the industry and keep abreast of changes in production and methods.

Currently there are short, less detailed reports being issued by other maple producing States. With some of these States we exchange information; this gives our New York reports more scope and out-of-State information is of interest to our producers.

Now in contrast to State reporting, about the only source of regional crop reporting is covered in the U. S. D. A. report. This is a summary report put out in May after the production is finished. Most of you are familiar with this report. It gives a short rundown on the season by States, production figures, prices, and dollar value. Data obtained for this report are from the questionnaire method with the aid of State-obtained information. Figures received are weighted, estimates are made, and the results issued in report form.

Methods of compiling the information may differ slightly by States or sections. For example, prices received are figured in New York State on gallon prices only, whereas those received from the Boston office for New England are figured on all sizes of containers and then converted to a gallon equivalent. This probably accounts for the consistently higher prices reported out of New England than those reported out of New York State. I am not familiar with the U. S. D. A. methods used for States south and west of New York, but I assume personal contact and questionnaires are used.

This then is the current maple crop reporting picture. I will give you a verbal outline of some of the changes and trends.

For example, the use of pellets. When first they arrived on the scene, there was considerable difference of opinion as to their value. The first year they were put in use, we had our laboratory check samples from producers who used pellets. We found only an occasional trace of formaldehyde. At that time we estimated less than 10 percent of the

producers used pellets. Based on last year's information from our cooperating producers, which we feel is indicative of all State producers, there were over 80 percent using pellets. Each year through 1964 we have spot-checked sirup where pellets were used and none have checked over one part per million residue. Better than 80 percent of the producers checked felt that pellets had helped production and many felt that their overall quality picture had improved. Because tests have proved that if pellets are used according to the recommendations there is little chance of harmful amounts of formaldehyde accumulating in the sirup, and the increased number of producers using pellets has proved their worth.

Another change has been in the use of plastic tubing, the use of which has increased in the past 8 years to slightly under 50 percent. The increase has been gradual but consistent. This figure, of course, includes producers using plastic in only part of their operation.

Two other changes that are gradually coming into the picture are: (1) Buying of sap from others and (2) renting of trees. Our latest figures indicated that approximately 10 percent of the producers buy sap and approximately 4 percent rent trees.

One other factor that we have been interested in is the potential for increase in production on the part of our producers.

From time to time we have queried our cooperating producers as to how many trees they have economically available that they do not use now. Our latest information, obtained in 1964, was that these producers had available 48 percent more trees than they were using. This figure is probably low for the State because there are many bushes not being used. However, just considering this figure of 48 percent--this is for trees economically available--the State in a good producing year like 1964, could probably have produced 800, 000 gallons with not too much of an increase in expenditures on the part of producers. You will probably recognize this as one of those educated "guesstimates" discussed earlier, but it is food for thought.

A REPORT ON MAPLE DECLINE RESEARCH CONDUCTED AT THE UNIVERSITY OF MASSACHUSETTS

By John H. Noyes, Extension Professor of Forestry, University of Massachusetts, Amherst

Much interest has been directed to the apparent poor state of health and high rate of mortality of sugar maples along New England roadsides and elsewhere within the normal range of this tree. Briefly described, the symptoms of sugar maple decline may include undersized, yellowish and sparse foliage, premature fall coloration, a dying of branches in the upper crown and a reduction in growth rate. An entire tree may die in a 3- to 4-year period, but some trees seem to have arrested their decline and some may recover. Decline is noted more in older trees than in younger ones and is more prevalent in trees that in one way or another have been disturbed by man.

The sugar maple is an important tree. The commercial value of the wood is high. It is a majestic tree especially valued for shade and for its superb autumn coloration. It is a tree of great importance to maple sirup producers. Like the American chestnut of years past it is a tree of inestimable value to our northern woodlands and roadsides. Its loss would be great indeed if it should disappear from our landscape.

Foresters, town tree wardens, and the general public have been noting a declining situation in many sugar maples over recent years but impetus to a current program of investigation in Massachusetts was provided by Representative John D. Barrus of Goshen. Aside from being in the State Legislature, Representative Barrus is a tree farmer and owner of a substantial acreage of northern hardwood forest land. During the 1963 legislative session, Representative Barrus contacted Arless A. Spielman, Dean of the University's College of Agriculture about the obvious situation of declining sugar maples in the Commonwealth. A careful preliminary study of sugar maple decline in the State by Representative Barrus in conjunction with the University indicated the generally widespread nature of decline along roadsides and to a somewhat lesser extent in sugar bush areas. The need for and urgency of investigation was emphasized also by the past history of our American chestnut and American elm. The State Legislature, therefore, in 1963 appropriated a sum of $25,000 specifically earmarked to aid the University in initiating a research program for the cause and possible cure of sugar maple decline. In 1964 an additional $30,000 was appropriated. Federal funds for research in forestry have also been made available to supplement State appropriations.

Although exploratory and extremely valuable investigative work on sugar maple decline has occurred in several States including Massachusetts, New York, Vermont, New Hampshire, Pennsylvania, Michigan, and Wisconsin, a specific determination of decline causes has yet to be found. As a result it was decided that the University of Massachusetts would establish a research team that could attack the problems simultaneously through a variety of approaches. This team as currently constituted includes three pathologists, Walter M. Banfield, Francis W. Holmes, and Malcolm A. McKenzie; a virologist, George N. Agrios; a nematologist, Richard A. Rohde; an entomologist, William B. Becker; and three soil scientists, John H. Baker, Donald L. Mader, and Lewis F. Michelson. Until very recently Arthur H. Westing, a tree physiologist, headed up this team. Assistance in the program has been provided by several foresters including Arnold D. Rhodes and myself. While maple decline investigations have occurred, as stated earlier, in many other States I think it is the first time that a team of this nature involving many different talents and abilities has concentrated on the decline subject.

A first project was to find out where sugar maples seem to be declining. It was known that roadside trees exhibiting decline symptoms were prevalent in much of Massachusetts, especially in the western part of the State. Less information was available about declining trees in sugarbush areas and in natural forest areas. A survey was conducted among members of the Berkshire Pioneer Maple Producers' Association requesting from individual members information on sugar maple decline on their own properties. From this information it was possible to determine locations for field study. Much credit is due members of the Berkshire Pioneer Maple Producers' Association for making available to the research team their properties for field study.

A concurrent project was that of reviewing all available literature on maple decline by each team member in his own field. Also, it was possible to bring to the University other highly concerned research workers in the region to report on their investigations on sugar maple decline.

I think it would be most appropriate at this time to report to you the most current activities of the research team members. It would be nice to report substantial breakthroughs in the investigation regarding maple decline. Unfortunately this is not possible and the very nature and complexity of this research project would indicate the likelihood of rather long-term investigation.

Briefs From Team Members:

In December 1964, Walter Banfield, a pathologist, reported extensive summer and autumn observations of sugar maples growing throughout northwestern Massachusetts, tentatively concluding from the decline syndrome that the decline was not caused by a fungus or other infectious agent, but rather the result of adverse environmental factors. His preliminary findings all pointed to a water deficiency as being the primary cause of the decline. In a recent abstract circulated among all attending the August 5 to 6, 1965, meetings of the Northeastern Division of the American Phytopathological Society, Banfield restated that, "maple decline appears to be the resultant of adverse environment in which increasing stress for soil moisture is the dominant etiologic factor. This stress follows from cumulative subnormal annual precipitation--especially seasonal--shallow soils, root damage, loss of ground cover and leaf litter, and abnormal exposure." Dr. Banfield also noted that decline, "appears on trees growing on the shallow soils of rocky slopes or ledges... in trees whose root systems have been mangled by logging operations, plowing, trucking operations, or by cattle walking across the soft soil of swales."

Francis Holmes, a pathologist, reports the following concerning salt and fungi and bacteria:

"Analyses of leaf tissues of sugar maples near Massachusetts roads salted only in winter showed that those with little or no foliar injury had low foliar chloride levels (0.05 to 0.6 percent by dry weight) whereas those with severe leaf scorch had high foliar chloride levels (1 percent or more). Severity of injury was not similarly correlated with the sodium levels in maple leaves or sap."

Many different fungi and bacteria have been isolated from maple tree tissues by standard laboratory culture techniques employed in the program of the Shade Tree Laboratories, University of Massachusetts. Maple samples were obtained both as a result of inquiries from town and State officials or from tree-owners, and also as a result of deliberate search for diseased trees by a graduate student, Roger Farrington, recently assigned to this project. He is now engaged in identifying some of these organisms, isolated from the maple tissues.

As yet we cannot point to any single organism that has appeared frequently or consistently. Many of the usual disease organisms, such as Verticillium, Cytospora, and Nectria, appeared from time to time in 1964 and in 1965. Inoculations were attempted in 50 well-established sugar maples, using some of the less-common organisms isolated; but no symptoms of decline were observed in these trees later. Cankers that formed after inoculations with certain isolates proved them to be Nectria cultures that had not been identifiable by their growth in test tubes alone. Dieback occurred on several of 360 young maples planted in the experimental nursery in spring of 1964. Usually these were associated with transplanting injury, but in several cases they were associated with fungal infections. (e.g., Cytospora) that may have occurred through wounds incurred in the transplanting operation.

Dr. George N. Agrios, a virologist, reports the following:

"The condition of maple trees described as maple decline is characterized by symptoms similar to those observed on other kinds of trees and which in some cases have been proven to be caused by a virus. To investigate the possibility of viruses being wholly or partly responsible for maple decline, a series of transmission experiments has been carried out to determine first whether any virus or viruses are present in declining maple trees.

"Dormant buds obtained last winter from more than 40 'declining' maple trees were indexed this spring on a total of 700 seedlings of 7 tree species employed as indicator hosts. Also buds from selected declining maple trees were indexed on 60 of 6 maple species. No definite virus symptoms have appeared on the indicators so far and the inoculated trees will continue under observation for at least another year.

"Mechanical transmission experiments were carried out in the greenhouse during the last 7 months. Sap obtained from young leaves or phloem of declining maples was applied to the leaves of 36 kinds of young herbaceous plants employed as virus indicators. Several variables such as type and age of tissue producing the sap, method of grinding, buffer used, method of application of the sap on the leaves, and the temperature and lighting of the inoculated plants before and after inoculation were also studied during these experiments. Except for one case of development of viruslike symptoms on one indicator host, which has not been reproduced yet, no other virus symptoms have been observed to date. Mechanical transmission experiments are also being continued."

Dr. Richard A. Rohde, a nematologist, indicates the following in his progress report:

"In cooperation with other workers on this project, 17 plots were selected in western Massachusetts to represent healthy and decline areas in a variety of woodland habitats. Soil samples were collected from all plots in January through March, in May and again in August. Root samples were collected in May and in August. In the first collection, samples were taken at depths of 0 to 12 inches, 12 to 24 inches, and 24 to 36 inches. Since very few nematodes were found below 24 inches, the second and third collections contained only samples from the humus layer where roots were abundant and from the soil below this layer. A total of 125 soil samples were taken in the first collection and 90 soil samples and 45 root samples in each of the subsequent collections.

"Soil samples were processed both by a Seinhorst elutriator and by sugar flotation. Higher numbers of nematodes were found associated with declining trees, the most common genera being Criconemoides, Hemicycliophora, Tylenchus, and Xiphinema.

"Roots were both stained and mechanically shaken in water for 3 days but did not yield any endoparasitic nematodes.

"Maple seedlings and whips growing in the greenhouse have been inoculated with Xiphinema, Hemicycliophora, and Criconemoides. While some symptoms have been produced, no definite conclusions can be drawn at the present time."

Dr. William Becker, an entomologist, reports on the checking of 18 field plots in woodlands and pastures. Roadside trees were excluded.

"In undisturbed woodlands no evidence of decline was observed. In plots where man had either performed thinning, harvesting or where he had opened up the stand in one way or another some declining maples were noted. Trees in open pasture showed evidence of decline as they did also in hedgerows and especially where grazing was common. Sizes of trees affected were 6 inches in diameter at breast height (d. b. h.) to mature 18 inches to 24 inches d. b. h. trees.

"In no cases were insects found where they could be associated with the damage or the damage attributed to them. This applied to trees wherever the maple borer occurred. That is, the sugar maple borer could not be associated with any declining trees.

"In Savoy, Mass., on one plot the saddled maple prominent had defoliated maples probably from 1960 to 1962. This plot will be studied further to see if some measure of the insect damage can be made. Increment borings will be taken to try to correlate lack of growth with the defoliation using damaged maple and beech trees with non-defoliated ash and hemlock trees which are present on the plot as a check."

Artificial Defoliation--Two years' observations have been completed in artificial defoliation. In this experiment 250 small saplings have been defoliated artificially with clippers. This work has been done in early June and in early August. On large trees one branch is defoliated. The trend seems to be as follows: More mortality occurs from trees defoliated in the spring and more mortality from trees defoliated in the shade than in the sun. The experiment intended to run at least 3 years is designed to see what effect defoliation has on the tree.

"In August defoliations trees sometimes put out new leaves and sometimes just formed buds which are small and probably tender making them susceptible to winterkill."

During the experiment in artificial defoliation Dr. Becker is also looking for any signs of damage by sucking insects and insect defoliators.

He tentatively concluded that the decline is not the result of insect damage.

Dr. John H. Baker, a soil scientist, reports on his investigation in the relationship between salt concentrations in leaves and sap and the decline of sugar maples along roadsides.

"Chemical analysis of leaves from sugar maple trees appear to confirm reports from New Hampshire[1/] and Connecticut[2/] that sugar maples growing along roads may be injured by salt applied to the roads. Leaf samples collected in the vicinity of Amherst,

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1/ LaCasse, N. L., and Rich, A. E. 1964. Maple Decline in New Hampshire. Phytopathology 54: 1071-1075.

2/ Button, E. F. Uptake of Chlorides by Sugar Maples from Rock Salt Used for Highway Ice Control. Mass. Turf Bull. 2 (10): 11-13. 1965.

Mass. in late July 1964 and 1965, from roadside sugar maples contained more sodium and chloride than leaf samples from sugar-bush trees. Leaves from maples exhibiting severe leaf scorch symptoms in late July 1964 and late July 1965, contained more than 0.18 percent chloride while leaves from trees that appeared healthy at that time contained less than 0.73 percent chloride. The two trees that appeared healthy when the leaf samples were collected but contained more than 0.7 percent leaf chloride developed leaf scorch symptoms later in the summer. The leaf scorch symptoms seem to be more closely related to chloride than sodium concentrations in the leaves. The greatest concentration of sodium, 840 p.p.m. was found in leaves from a tree with no scorch symptoms while, in contrast, leaves from a tree with severe scorch symptoms contained only 40 p.p.m. of sodium."

Dr. Donald L. Mader, a forest soil scientist, reports on the etiology of sugar maple decline in Massachusetts as follows:

"The present study is an effort to determine if any relationships exist to soil and site conditions, and to initiate studies on the importance and character of such relationships.

"Areas under study are arranged in pairs, one half in forest stands and the other half in sugarbushes. Analysis is divided into two phases. First, soil analysis for nitrogen levels, acidity, exchangeable cation levels, moisture-holding properties, and other site related factors. Second, a foliar analysis study will be carried out to determine relative levels of total nutrient content. These nutrients will be the same as those determined for soil analysis with the addition of copper, zinc, and aluminum. The foliar analysis is to aid in the diagnosis of nutrient deficiencies or imbalance. No conclusions can be made at this time.

"A second project entitled, 'Investigations of the influence of tree nutrition on the incidence and severity of maple tree decline in Massachusetts,' is now in progress. Relationships will be examined by determining the effects of supplying certain nutrients as fertilizers to declining and vigorous trees. Preliminary results show that in those trials where nitrogen was part of the fertilizer treatment yellow-green leaves became greener in color. Further analysis and observation will be needed before reliable conclusions can be made."

Dr. Lewis F. Michelson, a soil scientist, reports briefly as follows:

"Soil moisture determinations were made on the micro-climate plots established by Dr. Banfield using three methods of measurement: Coleman fiber glass sensing units, plaster of Paris units, and gravimetric.

"Results from the Coleman blocks were very erratic, while those of the plaster of Paris were consistent with the gravimetric determinations. No levels of real moisture stress were encountered in these plots this year and moisture levels within the decline plots were generally higher than the normal control plots."

The following excerpts are appropriate to this report and are taken from an unpublished report by Arthur H. Westing entitled, "Sugar Maple Decline and Evaluation," dated August 9, 1965.

"To judge by the state of recent articles in the popular and semipopular press, one would conclude that sugar maples have been declining only during the past half dozen years or so. But this is certainly not the case. For example, large numbers of declining sugar maples were observed in the late forties, early forties, and midthirties. It appears that

there have been periods of particularly pronounced sugar maple decline during the first decade of this century, again in the thirties and now in the sixties. In fact, during the past several years, there have been indications that the declining forest sugar maples are exhibiting a trend toward recovery in several regions. Improved woodland conditions have been reported for southern Ontario, Quebec, Michigan, central New York, and Maine."

As to severity of maple decline "there is little precise information on the current severity of sugar maple decline. What few quantitative data are at hand are difficult to evaluate for lack of a basis of comparison and because of the different standards employed. As indicated above, declining sugar maples appear to be most prevalent along roadsides, much less so in sugar bushes, and least so in the forest."

External contributing factors--"Decline in sugar maples is known to result from such diverse causes as drought, prior defoliation, salt applied to the roots, hot, dry winds, severe attacks by the sapwood boring insect glycobius speciosus, the root rot armillaria mellea, sapwood attacking fungi, and occasionally verticillium albo-atrum."

As far as fungi and bacteria are concerned, Westing cites a conclusion reached by Tessler, Anderson, and Hart in Michigan wherein they state that "no particular fungus or bacterium can be pointed to as the primary cause of sugar maple decline."

In regard to insects and mites, "The severe decline of sugar maples prevalent in a small portion of northeastern Wisconsin during the late fifties (sugar maple blight) turned out to have resulted from prior insect defoliation, but such activity does not appear to be the cause of the widespread decline (Lake States Forest Expt. Station, 1964)."

"Nematodes collected from the roots of some sugar maples could not be associated with decline in Wisconsin, New York, New Hampshire and Massachusetts." Investigations in several of these States are being continued however.

Viruses--Viruses are not now known to parasitize sugar maples, and only a very few have been reported so far for any species of maple. Westing states that "viruses, however, are multifarious creatures and cannot as yet be similarly dismissed."

Abiotic--"Environmental factors assume considerable significance since pathogenic organisms do not seem involved in a primary sense."

Precipitation--" A deficiency of precipitation appears to be the most important of the abiotic invironmental factors contributing to the decline of our sugar maples. There are several indications that the decline is associated with drought.

"The leaf symptoms of decline such as scorch and early abscission are often evident during a year of drought but the more severe effects such as twig and branch dieback do not become alarming until about 2 years after a year of low precipitation."

Temperature--"There are indeed several indications that sugar maples are quite sensitive to an elevated growing season temperature. For example, in several parts of their range sugar maples seem to do best on the cooler slopes. Westing continues that he is inclined to consider the current warming trend as not being of sufficient magnitude to contribute significantly to the decline of our sugar maples."

Nutrition--"Although the decline of sugar maples does not appear to be a nutritional problem in a primary sense, a few points can be made under this heading. During a period of drought, soil moisture can drop to the level where the salts in solution become concentrated

to a harmful extent. First, the osmotic concentration of the solution can reach a level where it becomes difficult for the roots to absorb sufficient soil water. Second, some salts may be concentrated to toxic levels."

Soil pollution--"Since sugar maple decline is most evident along roadsides, it is natural to wonder to what extent the ever increasing amounts of salt (usually NaCl or $CaCl_2$) applied to roads for winter snow control are involved. Once absorbed, salts accummulate in various parts of the plant and, in high enough amounts, can exert a toxic effect, although in just what manner it is not yet completely clear."

Air pollution--"Both the amount and variety of atmospheric pollutants have been increasing dramatically over recent decades... it does not seem to be a primary factor in the decline of sugar maples since a comparison of the geographical distribution of decline with the distribution of our population or with that of our consumption of automotive fuel, reveals no coincidence." Some reports, however, indicate that decline is much more prevalent on State highways rather than on town and country roads. This would indicate sugar maples to be relatively susceptible to injury by gas fumes and smoke.

Tree age--"As trees age their growth rate diminishes, their sensitivity to environmental stresses and to pathogens increases, their leaves become smaller, and the branches dieback (Westing 1964)... that as yet no one has investigated the important question of current decline of sugar maples in regard to old age."

Conclusion

We are pleased with the interest taken by our research team investigating sugar maple decline in Massachusetts and by the interest and support of others in our work, including the National Maple Syrup Council. Briefs of the current status of investigative work by the University of Massachusetts research team have been presented.

So far, no primary pathogen has been found to which the decline can be attributed. Westing states that "The current prolonged and severe drought appears to be the most likely candidate since past periods of drought where also associated with widespread decline... and that relatively severe decline of sugar maples appears to result from the narrow limits of tolerance characteristic of the species... to drought, to an exceedingly shallow root system, and perhaps also to a sensitivity to cell dehydration."

I cannot improve on Westing's statement that "additional research, a change in the weather and time will tell."

CHAIRMAN: Marvin E. Smith

INTRODUCTORY REMARKS ON MINNESOTA'S MAPLE EXTENSION PROJECT

By Marvin E. Smith, Extension Forester, University of Minnesota, St. Paul

I believe it is appropriate to state that extension education in the subject area of maple sirup production experienced a definite renaissance in 1963.

Previous to this time, modest amounts of maple sap products were produced in east-central Minnesota. Historically, this region was generally recognized as the State's maple producing area, and it is probably fair to state that before 1963 fewer than 100 producers in this particular district accounted for 75 percent or more of the State's annual production. As a matter of fact, the image of Minnesota maple production was so firmly identified by most everyone as being confined to this region that we detected a certain amount of apathy if not skepticism to earlier efforts aimed at enlaring the base of maple production in the State.

For those of you who represent States where maple sirup production is a firmly established enterprise, it may come as a surprise to learn that as recently as 5 years ago only the most fragmentary information was available on the volume and distribution of maple timber in the State. Forest surveys prior to 1960 lumped several species in the category of "northern hardwoods;" hence we were obliged to rely heavily on personal observations and reports from others for preliminary data.

Further stratification in the 1960 Forest Survey has given us more definitive information on the occurrence, size distribution, and number of sugar maple trees than we've ever possessed before. Based on data gathered in this forest survey, it is estimated that Minnesota woodlands contain over 10 million sugar maple trees measuring 10 inches d. b. h. and larger. This is growing stock, not including culls. Best estimates are that no more than 1 percent of the maple trees are presently tapped. This conclusion is inescapable--based on sap yield alone, the maple resource could be the basis for a 10 million dollar industry; where the benefits would largely accrue to rural families in economically depressed areas.

Scope of Program and Participation

a. Maple producer institutes--This phase of the program was inaugurated in 1963, and in February of that year two regional daylong meetings were held in cooperation with local county extension agents. Over 145 producers representing 33 counties attended these first institutes. In Waconia, where previously scant interest in maple was evident, 65 persons from 15 counties attended the meeting. To build on the gratifying response to these initial programs, we conducted three producer institutes in 1964 during the second week of February, and four in 1965. Over 150 people, including active and prospective sirup-makers and representatives of cooperating agencies, attended the programs in each of the last 2 years. Major program responsibilities have been divided among Marvin Smith and William Miles, extension foresters, and C. O. Willits, Aaron E. Wasserman, and John Kissinger from the Eastern Regional Laboratory in Philadelphia. Lynn Reynolds, maple producer and equipment dealer from Aniwa, Wis. has also contributed importantly to the success of these efforts.

b. Radio, television, and press--Informational releases were distributed to over 200 newspaper outlets in the State through the Information Service and local county agricultural agents prior to each maple tapping season. A variety of short topics and interviews

were taped for broadcast over the University Farm Hour on KUOM, other out-of-state stations, and major stations in the Twin City metropolitan area. Two or more television appearances were made by the extension foresters on a major farm program telecast and the University educational TV channel.

c. Exhibits--Consumer education has been the dominant theme in a fairly heavy program of exhibit work. In 4 years at the Minnesota State Fair an estimated quarter of a million people each year received some orientation as consumers by way of information by purchase of maple products at the State Fair booth. In this phase we've benefited by the cooperation of major sirup producers, and the State Department of Agriculture, and the Minnesota Honey Producers Association who provided ample space in their allotted areas.

Future Plans

Minnesota has an exciting potential for growth of a maple sirup industry. In many communities the extra income derived from tapping maple trees and making sirup and maple confections is particularly welcome because of underemployment and declining farm incomes.

Several indicators point to significant progress achieved so far in awakening woodland owners and others to the economic benefits to be shared in the development of maple production in Minnesota. A solid foundation has been laid for the organization of a central sap evaporator enterprise in northern Minnesota. The planning and studing of the economic possibilities are continuing in the framework of Rural Areas Development and community planning. The list of active maple producers now approaches 300; it continues to increase with each passing year.

Future extension programming in this project is predicated on two assumptions; namely, (1) that the particular educational objectives are inherently long-term in nature, and (2) that extension goals in terms of general adoption of the recommended practices will only be achieved to the degree that planning and execution are projected over a period of 10 years or longer.

Accordingly, it is proposed to extend the annual maple institute programs into other regions where sugar maple occurs, looking to the time a year or two hence when a series of 8 to 9 institutes will be conducted annually over all of the potential maple producing areas in the State.

Generally speaking, county agents have not had opportunity to acquire the educational background or experience necessary to work effectively as extension educators in a maple sirup project. Therefore, it is proposed to investigate the possibilities for holding a training conference in 1965 for county extension agents in the socalled maple counties.

Another move planned this year is to invite maple producers to meet for purposes of considering a proposal that a State affiliate of the National Maple Syrup Council be organized. A steering committee is presently drafting documents for the organizational structure and will present them for adoption before the end of the year.

THE ROLE OF THE EXTENSION SERVICE IN THE PROMOTION OF VERMONT'S MAPLE PRODUCTS

(Abstract)

By Raymond T. Foulds, Jr., Extension Forester, University of Vermont, Burlington

The Extension Service of the University of Vermont is an educational agency, not a promotional one, yet we are authorized to encourage people to adopt and use the new and better findings which come from research. To this extent we promote. Yet the real promotional work in Vermont is mainly the role of the Department of Agriculture or the Department of Development. The Department of Agriculture has a Maple Market Promotion Director whose position is made possible by funds appropriated by the Legislature. Extension helped to get these funds through the Vermont Maple Industry Council. The State funds are matched with Federal funds through the U. S. D. A. 's Consumer and Marketing Service. Thus $10, 000 is available each year for such work. Extension cooperates with the work when an educational objective can be achieved.

Educational work is also done by Extension through the Vermont Maple Industry Council, the Vermont Maple Sugar Makers Association, and county maple sugar makers associations. These latter are in Caledonia, Rutland, and Franklin Counties. The County Agents are active in the county associations. They are helped by the Extension Forester and by the Extension Specialist in Food Merchandizing.

A Maple month (March 15 to April 15) is used to promote the interest of the public in maple products. Activities include window displays, poster contests, sugar-on-snow parties, TV shows, radio broadcasts, and news articles. Extension cooperates with the Vermont Maple Industry Council and the Vermont Department of Agriculture to make this possible.

Festivals of various kinds help to promote sirup and candy sales. Other helpful activities are pancake breakfasts, often at or near ski areas; and displays and sales of sirup at Fairs.

Education of producers in better methods of marketing has been done through county meetings, circular letters, and newspaper articles. Operators of retail outlets have also been taught better methods of display and operation, with help here being given by the Extension Horticulturist, the Extension Forester, and the Extension Specialist in Food Merchandizing. Research has helped with studies of new market potential in large cities. A million-dollar advertising program has been recommended.

Special educational work involves action in Franklin County with the County Sugar Makers Association to obtain funds for an organization to package and to sell a quantity of sirup that would boost prices. Other work is under way with the Vermont Agribusiness Council to find a better market for a substantial quantity of sirup in the northern counties. Some work is being done through the Vermont Maple Industry Council to develop markets in foreign countries.

The Extension Service recognizes problems listed by Vermont sugar makers, which include the high cost of and shortage of labor; poor markets and a poor price; high costs of production and marketing; and the cutting of sugar bushes for logs. It seeks to help solve these problems in the role of expediter, organizer, teacher, and publicizer. Where possible organizations such as Associations and Councils are helped in doing an educational job.

MAPLE RESEARCH AT MACDONALD COLLEGE--1965

By J. D. MacArthur, Macdonald College, Montreal, Canada

The Macdonald College sugaring operation comprised 2,850 taps, 932 pipelines, and the remainder spouts and buckets. The operation is basically commercial to obtain revenue for the Department of Woodlot Management. However, research is undertaken to the extent that resources permit efforts to (1) improve our own practices, (2) provide demonstrations, and (3) adopt and develop methods that can assist the Quebec producer to improve his operation and increase his returns. In 1965 four aspects were investigated with the following results.

Effect of Paraformaldehyde Pellets on Sap Yield

In Quebec it is generally felt that the climate is such that taphole sanitization is unlikely to affect yield significantly. To confirm or refute this idea a careful test on the effect of pelleting was organized in 1965.

Four separate groups, of six 10-tree lines each, were used to compare yields from pelleted (paraformaldehyde) and unpelleted tapholes. A 10-tree line was a treatment unit. Each tree was tapped twice (east and west sides) and one hole pelleted. Pelleted tapholes were then connected by 1/4-inch Mapleflo[1/] tubing with 12-inch drops; likewise the unpelleted tapholes. Yields were collected separately for comparison; daily flow records were kept from March 13 to May 1. In addition to yield data, sap samples taken on April 4, 14, and 22 were analysed for the presence of bacteria and fungi.

Analysis of cumulative yield data indicated that pelleted tapholes exceeded controls by 14, 25, and 53 percent by April 20, 24, and May 1, respectively. Differences were highly significant (1 percent level) on April 24 and May 1. Analysis of periodic yield data indicated that pelleted yields were significantly higher from April 13 on. Pelleting also resulted in significant differences between numbers of bacterial and fungi present in the sap on April 22.

It is concluded that pelleting can have, in certain seasons, an economically important positive effect on sap yield. Even in Quebec such seasons may occur frequently enough to warrant the continued use of pellets.

Vacuum Pumping

This was the third year of testing vacuum pumping in a 425-tap installation. In the past yields had been much below those from both buckets and gravity tubing installations in other groves. In 1965 a number of changes were made in an effort to improve results. (1) The pump was relocated and the main lines graded, (2) paraformaldehyde pellets were used in all taps, and (3) 18-inch drop lines were installed.

Results were gratifying. Average yield per taphole was 5.3 gallons, which is considerably more than in former years and roughly double the yields from other 1965 installations. It is not possible, however, to separate the effects of the various changes.

[1/] Mention of brand or firm names does not constitute an endorsement by the Department of Agriculture over others of a similar nature not mentioned.

Reaming, Rinsing, and Fresh Tapping

In 1965 an early flow period ended on March 10 and was followed by a cold spell which lasted until early April. From April 14 to 28 a small test of methods of stimulating sap flow was conducted.

Twenty 2-tap trees were chosen (1) one tap was left untouched, (2) one was either rinsed with a 1 to 10 solution of commercial Javex[1/] or reamed out 1/16 of an inch larger, and (3) a new hole was bored in each tree. Records of flow were then kept from April 14 to April 28.

Yields in taphole gallons of sap were as follows:

Control	Rinsed	Reamed	New
0.4	0.8	1.0	3.5
0.4	2	2.5	9

While rinsing and reaming doubled yield, new taps were much more effective and no more work to effect. Because of the increased injury to the tree, however, the wisdom of fresh tapping remains dubious.

Buckets vs. Pipelines

In 1965 a number of buckets were established amid the various tubing installations and yields recorded for comparison. Particularly in the PFA study the results confirmed former observations that properly installed tubing gives slightly higher yields than buckets. At best bucket yields were roughly equal to those from tubing.

1/ See footnote 1 on preceding page.

THE CANADIAN MAPLE COOP: ITS HISTORY, PHYSICAL PLANT, AND ROLE IN CANADIAN SIRUP PRODUCTION

By Joseph O. Vaillancourt, les Producteurs de Sucre d'Erable de Quebec, Quebec, Canada

I am proud of our Cooperative not only because it is the largest organization in the maple sirup field but also for the services it has rendered to our Coop producers and independent producers of maply sirup, especially those of the province of Quebec. Corporations which are using high quality maple products today agree with us that the Coop has saved the industry in Quebec. I do not have information on the U. S. maple industry before 1924. I do not know if the problems were similar to ours; but in Quebec, quality was not always the objective. It is necessary to refer to this situation to understand why the Coop was organized. At that time, grading was not used by maple buyers. Without quality control and without organization, producers were in a very weak bargaining position. To sum up, they were exploited by unscrupulous buyers, but part of the difficulty was of their own making. This was enough to kill the industry. Something had to be done.

Senator Vaillancourt, my father, was at that time a government officer in charge of the Beekeeping Division for the Department of Agriculture in Quebec. He was fairly well acquainted with the situation and conceived the idea of a coop for the maple producers. That was the best way to educate the producers and save the industry. He devoted his spare time adding to his knowledge and looking for loyal associates who would dare to venture with him in such an organization. He enrolled a friend of the farmers, Edgar Samson. In 1924 they formed a group of 17 producers. The share in capital was fixed at 10 dollars per member payable at a rate of 1 dollar a year, and the organization was named "The Association of Pure Maple Syrup and Sugar Producers of the Province of Quebec." With the little cash available, they bought 1-gallon cans which were allocated to the 17 farmers. During the maple season, a group of provincial technicians aided these farmers, teaching them how to proceed with their production. During the first year in business, around 3,000 pounds of sirup were received by the Coop. Undoubtedly a humble beginning; but, with such a devotion to duty, it was impossible not to trust in the future. The scheme was launched and everybody seemed to be satisfied--the producers as well as the customers. From that time on, they enlisted new members. In spring of 1925, they had 102 producers. That membership was sufficiently large to request a charter which was granted on May 2, 1925. The name was changed to "The Maple Sugar Producers of Quebec." The group of technicians continued to aid the producers and to inform them about cooperation. In the mind of the promoters, it was preferable to educate a small group of producers who, later on, would be in a position to propagate the "value and the importance of group action."

In the second year, the Coop received 10,700 pounds of sirup and 93,000 pounds of sugar. In 1927, a plant and a warehouse were built at Plessisville, a good maple sugar section, as well as a railroad communication center. At the end of 1928, the first processing of maple sugar took place in a small building of around 3,000 sq. feet. In 1929, the membership reached 1,572. The volume was then big enough to start exportation. From 1929 to 1935, the young Coop had to fight very important financial opposition. Nevertheless, competition of all kinds failed to deter those who were responsible for the social and economic recovery of this industry.

In 1930, the Federal government established the classification for maple products in Canada. The same year the Coop organized its own laboratory. Mr. Armand Roberge, chemist, was named in charge. His responsibility was the quality control of the Coop production. The main objective was the improvement of the Coop products. Quality

standards were established to bring the industry up to a higher and more profitable level for our producers as well as for the customers of the Coop.

In April 1936, a new problem had to be solved. The lead traces in maple products had to be removed. At that time, Edouard Landry joined the Coop as second chemist. His work in cooperation with Mr. Roberge brought a solution to this problem. Mr. Landry took charge of the laboratory in 1940 when Mr. Roberge was promoted to superintendant of our plant. Since that time, both have worked to improve the Cooperative's products. Our laboratory is one of the best in the industry and our quality control is one of our points of sale and our guarantee. After 40 years of operation, one might be under the impression that all problems have been solved. This is not true and every year there are new ones.

Today we have close to 6,000 producer-members in the Coop and 45,000 drums are at the disposal of our members. The daily capacity of production at the plant or, if you prefer, the quantity of field sirup which could be made in 9 hours is over 100,000 pounds. This sirup is shipped in tank cars or transformed into sugar or it is packed in bottles and tins for the retail market under the Coop brands CITADELLE & CAMP.

At present the Coop owns 1/2 million square feet of land on which there are 100,000 square feet of warehouses and 33,000 square feet of processing plant area. The Coop receives each year about 50 percent of the commercial crop produced in the province of Quebec. Since our founding, over 4 million dollars have been distributed to our members from the surplus realized. The crop received by the Coop is sold in Canada, United States, France, England, Germany, and many other countries including Japan which is the latest territory to be opened. We have stock in nine different warehouses to serve our customers in the retail market. All bulk shipments for the United States or Europe are made from the plant. Our sales are increasing constantly as is our membership.

In addition to the technical information given to our members, we offer them financial facilities and equipment which are not readily available in small quantity. Through the efforts of our Coop, in cooperation with our federal and provincial government, it was possible to change 82 percent of all obsolete buckets used by the producers in our province. For many years 22 million aluminum buckets have been in use. Some of these after 20 years of use still look like new. Without our organization this exchange would never have been possible. The result is that, this year, 80 percent of our sirup is lead free.

We work in cooperation with and for our citizens and personal as well as united effort has brought results. It is very hard to estimate the number of those who benefit from it. This is not only for our members but for all organizations who want to cooperate with us. We also supply containers to our members for their own retail sales. We encourage our producers to develop their own direct sales and to offer only the "AA" or "A" grade. The price they get is very interesting (at least $5 per gallon). It is the best promotion and advertisement the Coop receives for its own brand. Farmers supply their customers in the springtime only. After the season, the Coop takes care of the demand. I would like to point out here for people who consult Canadian statistics that there is an adjustment which is necessary in the total value figures given. We estimate that one-third of the total crop is sold directly by the producers. The price on this is not computed in the statistics for the province of Quebec. This is the reason that the price per pound is always under that of the other provinces where the crop is small and is sold at retail. The figures published in an article concerning the international aspects of the maple business in the National Maple Syrup Digest of February 1965 must be corrected.

Finally, I want to say that we are not building our Coop in an effort to destroy other organizations, we just follow the objective of its promoter. All those who are

directly connected with that industry have to agree with those facts. I trust that you now have a clearer picture of our cooperative life.

The following presents statistics on our Quebec French Maple Products Cooperative--Les Producteurs de Sucre d'Erable de Quebec:

Assests	dollars	2,030,545.86
Last year's sales	dollars	3,619,939.86
Surplus redistributed since the foundation	dollars	4,176,090.22
Pounds of sirup received since the foundation	pounds	215,459,553
Members (end of 1964)	numbers	5,727

THE PENNSYLVANIA MAPLE INDUSTRY

By Edward P. Farrand, Extension Forester, Pennsylvania
State University, University Park

Most of you who drove to this conference came through a small part of Pennsylvania's 15 million acres of forest land. We hope you enjoy the autumn foliage coloration in this area on your way home.

The extension education program for maple producers in Pennsylvania is based on research and encouragement. The research findings at this Laboratory have been and are invaluable to our producers. We find that a considerable amount of encouragement or prodding is necessary before maple producers will try some of the new developments.

Conventional extension methods are used in this State with maple sirup makers such as county meetings, demonstrations, tours, exhibits and the mass media of news items, radio, and television. Much of this is done in cooperation with the State and local maple sirup producers organizations.

I would recommend the type of State Council of Maple Producers which has been operating in Pennsylvania for 2 years. It is composed of two delegates from each of five areas of the State. These areas include from two to five counties each and embrace the whole producing area. The local associations carry on their own program of education and promotion in cooperation with the county agents. The State council meets about four times a year and serves as a leader and mouthpiece for all maple producers of the State, including representation on the National Maple Syrup Council.

With increasing interest in the separate production of sap and central evaporating plants, the reinventory of forest stands soon to be released by the U. S. Forest Service is keenly anticipated. The data will include the number and volume of trees in each county by species and diameter class and will greatly facilitate planning possible locations for evaporating plants.

In addition to recent research developments in maple sirup production, the change in the American economy and renewed attention to all our natural resources have created more interest in maple sirup. We hope this trend continues and that Pennsylvania along with the other maple States will increase its efficient development of the sugar maple resource.

NEW MAPLE DEVELOPMENTS AT EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

By C. O. Willits, Eastern Utilization Research and Development Division

The 3 years which have elapsed since we reported on our work to you at the preceding maple conference have been exciting and fruitful.

Sap Harvesting Studies

The taphole germicidal pellets were first made commercially available during the spring of 1962--the year of our last conference. Since then we have had a chance to appraise them. The results appear to be mostly good. The major effects as determined by reports reaching us are: improvement in the quality of the sirup made from treated sap, increased sap yields, and the creation of conditions whereby trees can be tapped early (ahead of the sap flow season) permitting the sap producer to utilize his time better. The current 1965 sap season in many areas proved its value by extending the useful life of the taphole late enough into the season so that the last large flow of sap was realized, without which many bushes would have reported a sap crop failure. However, use of pellets extends the sap flow season into the period when buddy sap begins to flow. In anticipation of this we have (a) developed a chemical test and an odor test for detection of buddy sap, and (b) developed a method to remove the buddy principal from either buddy sap or from buddy sirup. The chemical test for buddiness is quite rapid but not enough for roadside tank truck pickup. The test is an adaptation of the ninhydrin test for free amino acids.

The reclaiming of buddy sap or buddy sirup is a fermentation process by which the free amino acids in sap, which appear to be implicated in buddy flavor formation, are removed by fermentation of either the sap or a diluted sirup, with a culture of *Pseudomonas geniculata*. The resulting sirup is free of buddy flavor, and therefore, of commercial value but due to its dark color and strong flavor is classed as commercial.

While the move towards establishing central sap evaporation plants began several years ago, the past 3 years has seen the largest growth in these plants both in number and in size. One of the major problems in maple sirup making is obtaining and keeping sap sound and unfermented. Fermentation is the direct cause of dark color and unwanted flavors in maple sirup. The central evaporator plants focused attention on this problem. Earlier work here indicated that the actinic rays of ultraviolet irradiation would cause the destruction of microbes in maple sap. Tests over the past two seasons have proven that field tanks for the collection of maple sap, when provided with overhead ultraviolet germicidal lamps with which any sap in the tanks can be continuously irradiated, will control microbial growth in the sap. At the Laboratory, sap collected and held in outdoor tanks under ultraviolet irradiation was kept sterile for 2 weeks even though air temperatures were as high as 80° F. The sirup made from this 2-week-old sap was of fancy grade and of excellent flavor. The depth of penetration of ultraviolet rays of 260 mμ in clear maple sap has been calculated to diminish 0.5 percent per cm. or 50 percent effective at a depth of 5 feet. Since no data are available on the exposure required to kill sap organisms at different depths below the irradiated surface, we are conducting such a study now.

Further, since commercial units are now available for controlling the microbial growth in a flowing stream of water, we are now engaged in such a study testing their use for maple sap. These tests have already shown that a stream of infected sap flowing in a 1/2-inch concentric layer about a long germicidal tube, required only 8 seconds to effect a 99 percent kill of the contained microorganisms. These data have supplied information that is now being applied to studies on storing sap at central plants.

Sirup Processing Studies

During this period we have demonstrated the effectiveness of the use of a separate pan for completing the final stage of the evaporation of sap to sirup. This has brought about a revival of its use for making possible the production of a lighter grade (lighter colored) sirup and a savings in man-hours spent in sirup making. In general commercially available finishing pans that are gas-fired, usually are too large in size.

Another equipment improvement has been the use of tight-fitting steam hoods with stacks for steam removal. These have been widely accepted; for example today more than 50 percent of the evaporators in New York are so equipped, and the evaporator companies are now offering them as optional equipment. This method of steam removal has, more than any other development, made possible the construction of sap processing plants that are clean, warm, and steam-free which are factors necessary for the sanitary operations of the plant. Because these covers exclude air (oxygen) from the surface of the sap, they prevent the formation of scum on the boiling sap thereby eliminating the need for skimming the sap and reducing the material that has to be removed by filtration.

Another very important advance in sirup processing is in instrumentation. The only direct way to determine the stage of evaporation in boiling sap is by noting the elevation of its boiling point over that for water. Since the boiling temperature of sirup is not constant, but varies with changes in barometric pressure, a device has long been sought that would automatically correct the boiling point of sirup to compensate for changes in the boiling point of water. Such a device was not on the market nor could we find a company interested in developing one. Joseph Connelly of this Laboratory therefore undertook the task and successfully built two different models. Both have been field tested and have performed precisely as required. One of these, together with commercial models based on Connelly's design, is on display.

In principle, these instruments consist of two temperature sensing devices, probes, that are a part of a wheatstone bridge. When one of the temperature sensors is in boiling water, or its equivalent, it serves as the master; the other sensor, the slave, is placed in the boiling sirup. When the slave (sirup) reaches some predetermined temperature, such as 7° or 7.5° F. above that of the master (in boiling water) the slave sensor causes relays to operate which in turn can operate switches, lights and/or solenoid valves. Thus, when sirup reaches a predetermined boiling point (density), it can be automatically withdrawn from the evaporator or finishing pan.

With better methods of sap handling and processing being put into practice, 80 to 90 percent of the sirup produced is of the top two grades. This sirup is not only too light in color and too delicately flavored to permit its use in making cane sirup-maple sirup blends, the largest single use of wholesale or drum sirup, but some is too delicately flavored even for table use.

This sirup must be high-flavored, i.e. heat processed to bring out more flavor so as to make it suitable for these end uses. The previous high-flavoring process developed by this Laboratory, which is used to process 80 to 90 percent of the drum sirup, is slow and unwieldy. During the past year we devised a new process which is not only continuous but permits almost instantaneous changes in conditions so that the desired amount of high-flavored sirup can be obtained irrespective of the nature of the raw sirup being supplied to the machine.

Problems Yet to be Solved

In the handling and processing of sap to sirup, a large number of problems remain to be solved. A few of these are as follows:

1. Preservation of sap collected and held in tanks located in woods where there is no electric power lines.

2. Procedures for hauling sap long distances (50 to 100 miles) without spoilage.

3. Tests for sap quality for use in grading sap at the evaporation plant and at the site of the road tank pickup. In either case the sap would have to be tested before mixing a given lot with other lots of sound sap. This requires that these methods must not only be simple but very rapid as well. These sap tests would be for:

   (a) Microbial contamination.

   (b) Color as from bent wood, or leachings from bark or leaves and other sources.

   (c) Buddiness.

   (d) Amounts of invert sugar.

   (e) Maple flavor precursors.

4. Tests for concentrations of flavor in sirup.

5. Develop methods for the removal of sugar sand or sugar sand precursors, but which has no effect on the flavor of the produced sirup.

6. Develop methods for the removal of color derived from foreign sources.

Problems of Sap Processing

1. Improved filtering techniques.

2. Develop teflon coated evaporation equipment for finishing pans, sirup pans, and flue pans to eliminate sugar sand scale formation. This requires study of metal backing, thickness of teflon layer and its heat transfer properties.

3. Better packaging procedures, including new and improved types of containers (can or bottle), improved confections, and methods of packaging.

4. Establish the design for a completely integrated evaporation plant.

5. Develop procedures for adapting existing fruit and vegetable processing plants for use as sap evaporation plants.

New Maple Products

In addition to high-flavored maple sirup, we have developed and patented a fluffed maple product that is similar to maple cream but because of light texture, it is suitable for cake frostings. This product, unlike most maple confections, can be made from the lower as well as from the top grades of maple sirup. We have also

developed and patented a honey-maple spread which utilizes these two farm products, often produced on the same farm.

Currently we are working on new processes that may yield products that will cause maple sirup again to be used as a casing agent for cigarettes. We are also working on the formulation of a hard candy type of confection that would have a long shelf life. We are also working with meatpackers in developing a product for use in curing smoked meats.

Chemical Investigation

Color of maple sirup. --Color is important in maple sirup not because it has an intrinsic value but because it is a principal grade determining factor. We have now established the pathway by which the color is formed; this is by the following successive steps: (a) Fermentation in sap to yield hexose sugars; (b) alkaline degradation of these sugars to trioses during the first stage of evaporation; and (c) polymerization of the trioses to large polymolecules (color bodies) which occurs during the last stage of evaporation.

Obtaining pure unaltered maple-sirup colorant was only successful after we applied a new technique that was developed for the separation of large protein molecules from other substances. This procedure is called gel filtration. This technique effects a separation by retaining small molecules and by permitting only large ones to pass through the jelly-like filtering medium. The colorant of maple sirup is made up of brown polymeric molecules with molecular weights varying from 7 to 45,000 with an average weight of 12,000 and an imperical formula of $(C_{40}H_{76}O_{35}N)_X$. The macromolecules exist in two groups--those of the higher and those of the lower molecular weights. The ratios of the amounts of the high to the low molecular weight colorants vary with different sugar sirups. In maple, this ratio is low. In blended maple sirup, the ratio is high. Thus, this ratio provides another constant for judging the purity of maple.

Flavor. --This is the only part of maple that has any intrinsic value. It is that quality that makes maple sugar 80¢ or more per pound as compared to 10¢ for cane sugar.

What is Maple Flavor and What Can We do About it?

To identify it we must first separate it from the sugars and whatever else there is associated with it in solution. This is not easy. We now know that it exists in sirup in very small amounts--a few parts per million. It is not normal to maple sap but is made from materials in sap called flavor precursors which interact during heating (evaporation) of sap and especially during the last stage of the evaporation. We have approached the chemistry of maple flavor in two different ways. One is the isolation or separation of a fraction rich in maple flavor. This provides pure flavorant for study and analysis. The other approach is the isolation and subsequent identification of those substances from which the maple flavor is derived. We will designate these substances in maple sap as maple flavor precursors. A fraction of maple sirup rich in maple flavor and relatively free of sugars, color, lignins and salts was obtained by the classical procedure of liquid extraction--in this case extraction with chloroform. The crude chloroform extract was then purified and concentrated to provide a solution relatively rich in the flavoring substances of maple. This extract, when analyzed by gas liquid chromatography (GLC), has shown the major constituents present to be: syringaldehyde, dihydroconiferyl alcohol, vanillin, cyclotene, acetol, and acetoin. Of these, only the last four appear to have characteristics suggestive of maple as noted by the odor effluent from the GLC absorption tube.

All of these compounds are important and have aided our knowledge of maple flavor. For example, the discovery of syringaldehyde, which has the syringol group, suggests

that a part of the flavor is derived from a lignin-like substance. This group is known to be dominant in the lignins of maples which contain the dimethyl ester group of phenyl propanol. These compounds were obtained from a 2,000 fold concentration of the flavorants original in sirup. We now know that this concentration was not enough due to the minute traces of the flavorants present, other important flavor producing compounds being in such small amounts that they escaped detection. We, therefore, have proceeded to make much larger extractions using the new Corning[1/] "Glass Plant" in our Hazardous Operations Building. The other approach to the flavor identification problem consists of the extraction of flavor precursor components by selective liquid solvents from sirup that has been made flavorless and colorless by a prior extraction with chloroform. As of now since we have only succeeded in the selection of the appropriate solvent, no attempt will be made to discuss it further.

Participation in the AOAC

This is an area of work which has not been discussed in prior meetings. Chemical or physical methods of analysis of maple products and other substances used by State or Federal regulatory agencies are usually performed according to methods that have been proven for their accuracy and precision by collaborative tests conducted by the Association of Official Analytical Chemists (AOAC). We have worked with this orgnization serving as Referees for Methods of Analysis of Maple Products, and have been responsible for improvement in method for determining the conductivity value, the test most widely used and the first one applied for the detection of adulteration. Other AOAC methods of analysis include the determination of formaldehyde in maple sirup. This method which is specific for formaldehyde was essential for the approval of the use of paraformaldehyde pellets by the Food and Drug Administration, U.S. Department of Health, Education, and Welfare. Because of its specificity for formaldehyde it should be the one used in State or Federal regulatory work. Another method, which we have developed as an official method of the AOAC, is that for malic acid in maple sirup. The test previously used for maple products did not specificially measure the malic acid as such, but as a part of a mixture of organic acid salts of lead and it was less precise than the current one. We have also had accepted as an official method of the AOAC, the determination of the color of maple sirup by permanent glass color standards.

It is our hope that in our flavor studies we will be able to develop a test or tests that identify substances found only in maple sirup and not in cane or beet sugar sirup. Such a test may be the one we now have under study for the determination of syringaldehyde in maple products.

The ideal test would be one that identifies the sugar used as the adulterant to dilute maple sirup. Unfortunately, this is not a simple task since the most common adulterant used is sucrose, either cane sugar or beet sugar. This sugar already comprises 98 percent of the solids of maple sirup and does not differ chemically from that obtained from cane or beets. We hope we will find an inherent impurity in these two sugars that will identify them when they are used as maple sirup adulterants.

[1/] Mention of brand or firm names does not constitute an endorsement by the Department of Agriculture over others of a similar nature not mentioned.

LIST OF ATTENDANCE

Name	Organization	Address
Adams, R. B.	Rutland County Maple Producers	Cuttingsville, Vt.
Andersen, A.	Producer	Long Eddy, N.Y.
Andersen, A., Jr.	Producer	Long Eddy, N.Y.
Baltus, J. R.	Wisconsin Dept. of Conservation	Wausau, Wis.
Bascom, K. E.	New Hampshire Maple Producers Assoc.	Alstead, N.H.
Bascom, K. E. (Mrs.)	New Hampshire Maple Producers Assoc.	Alstead, N.H.
Beabes, N. E.	Producer	Hooversville, Pa.
Bechtel, K. D.	Producer	Guys Mills, Pa.
Bechtel, K. D. (Mrs.)	Producer	Guys Mills, Pa.
Bell, R. A.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Bochy, J. A.	Agricultural Extension Assoc.	Somerset, Pa.
Bowers, N.	Quebec Maple Products, Ltd.	Lennoxville, Que., Can.
Boylan, E. R.	Cary Maple Sugar Co., Inc.	St. Johnsbury, Vt.
Brennan, J. F.	John Paton, Inc.	New York, N.Y.
Brookman, G.	Maple Council	South Dayton, N.Y.
Brunner, T. D.	Goodall Rubber Co.	Trenton, N.J.
Buell, B. C.	N.Y. Dept. of Agr. and Markets	Albany, N.Y.
Buist, J. A.	Minn. Mining and Manufacturing of Can.	London, Ont., Can.
Burton, D. L.	Consumer and Marketing Service, USDA	Washington, D.C.
Clark, W. S.	Clark Bros. Maple Products	Wells, Vt.
Clark, W. S. (Mrs.)	Clark Bros. Maple Products	Wells, Vt.
Cook, L.	Producer	East Freetown, N.Y.
Cook L. (Mrs.)	Producer	East Freetown, N.Y.
Coombs, R. G., Jr.	Vermont Sugarmakers Assoc.	Jacksonville, Vt.
Coombs, R. G. (Mrs.)	Vermont Sugarmakers Assoc.	Jacksonville, Vt.
Cowen, W. F., Jr.	Ohio State Univ.	Columbus, Ohio
Croteau, G.	Les Producteurs de Sucre d'Erable de Que.	Levis, Que., Can.
Cullinane, E. A.	Madawaska Valley Maple Products Assoc.	Combermere, Ont., Can.
Currey, R. M.	Producer	Almont, Mich.
Currey, R. M. (Mrs.)	Producer	Almont, Mich.
Curtis, E. A.	Pennsylvania Maple Council	Honesdale, Pa.
Curtis, M. D.	Producer	Newfoundland, Pa.
Dinneen, R.	Maine Forest Service	Augusta, Maine
Doubleday, E. S.	American Maple Products	Newport, Vt.
Farrand, E. P.	Pennsylvania State Univ.	University Park, Pa.
Filipic, V. J.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Filipowicz, S.	Acme Markets, Inc.	Phila., Pa.
Foulds, R. T., Jr.	Univ. of Vermont	Burlington, Vt.
Franklin, D.	Burke Mt. Maple Co.	Newport, Vt.
Gowen, G. H.	New Hampshire Maple Producers Assoc.	Alstead, N.H.
Gowen, G. H. (Mrs.)	New Hampshire Maple Producers Assoc.	Alstead, N.H.
Grasser, G. F.	Producer	Berlin, Pa.
Gray, F. D.	Economic Research Service, USDA	Washington, D.C.

Name	Organization	Address
Green, D. B.	Confederated Foods of Canada Ltd.	Delta, Ont., Can.
Hager, C. F.	Producer	Bainbridge, N. Y.
Handy, C. F.	Lewis County Extension Service	Lowville, N. Y.
Harding, T. R.	T. R. Harding	Athens, Maine
Harding, T. R. (Mrs.)	T. R. Harding	Athens, Maine
Harley, J. C.	Penick and Ford, Ltd.	New York, N. Y.
Hauge, C. T.	Univ. of Wisconsin	Antigo, Wis.
Hepworth, A. T.	New Hampshire Dept. of Agr.	Concord, N. H.
Huff, M.	Ontario Dept. of Agr.	Toronto, Ont., Can.
Hughes, W.	Minn. Mining and Manufacturing of Canada	Waterloo, Que., Can.
Humphreys, W. A.	Ontario Dept. of Agr.	Barrie, Ont., Can.
Huxtable, R. B.	Sugar Bush Supplies Co.	Lansing, Mich.
Jaciw, P.	Dept. of Lands and Forests	Maple, Ont. Can.
Johnson, T. L.	Ohio Division of Forestry	Burton, Ohio
Jones, A. R. C.	Macdonald College	Prov. of Quebec, Can.
Kaban, M. W.	Producer	Lowville, N. Y.
Kaufman, R. D.	John Paton, Inc.	New York, N. Y.
Keim, G.	Producer	West Salisbury, Pa.
Keim, G. (Mrs.)	Producer	West Salisbury, Pa.
Kidd, W. E., Jr.	West Virginia Univ.	Morgantown, W. Va.
Kissinger, J. C.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Koelling, M. M.	Forest Service, USDA	Burlington, Vt.
Laing, F. M.	Univ. of Vermont	Burlington, Vt.
Lamb, R.	R. C. Lamb and Sons	Liverpool, N. Y.
Landry, C. E.	Quebec Maple Producers	Plessisville, Que., Can.
Lesure, R. L.	Berkshire Pioneer Maple	Ashfield, Mass.
Lesure, L. B.	National Maple Syrup Council	Ashfield, Mass.
Lothrop, R. E.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Lott, E. J.	Purdue Univ.	W. Lafayette, Ind.
Lusskin, A.	Lusskin Research	Englewood, N. J.
MacArthur, J. D.	Macdonald College	Prov. of Quebec, Can.
McCarty, R. H.	General Foods Corp.	Dover, Del.
Macry, J.	Empire Can Corp.	Brooklyn, N. Y.
Madden, J. C.	M and A Maple Sirup Co.	Carmel, N. Y.
Marvin, J. W.	Univ. of Vermont	Burlington, Vt.
Minor, E. S.	Statistical Reporting Service, USDA	Washington, D. C.
Moore, F.	Oc-Oc Tree Farms, Inc.	Ocqueoc, Mich.
Moore, P. D.	G. H. Grimm Co., Inc.	Rutland, Vt.
Moroney, R. H.	Vermont Evaporator Co.	Ogdensburg, N. Y.
Morrow, R.	Cornell Univ.	Ithaca, N. Y.
Murray, W. E.	Madawaska Valley Maple Products Assoc.	Combermere, Ont., Can.
Nehring, E.	The Quaker Oats Co.	Barrington, Ill.
Nessly, R. S.	Producer	York, Pa.

Name	Organization	Address
Noyes, J. H.	Univ. of Massachusetts	Amherst, Mass.
Pasto, J. K.	Pennsylvania State Univ.	University Park, Pa.
Peterson, T. A.	Univ. of Wisconsin	Madison, Wis.
Ratchford, W. P.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Reaves, J.	Reynolds Tobacco Co.	Winston-Salem, N.C.
Reynolds, A.	Reynolds Sugar Bush, Inc.	Aniwa, Wis.
Reynolds, L. H.	Reynolds Sugar Bush, Inc.	Aniwa, Wis.
Richards, P. S.	Richards Maple Products	Chardon, Ohio
Richards, P. S. (Mrs.)	Richards Maple Products	Chardon, Ohio
Roberts, N. E.	Information Division, ARS	Phila., Pa.
Rohde, W.	Reynolds Tobacco Co.	Winston-Salem, N.C.
Roy, C. F. L.	Quebec Maple Products, Ltd.	Lennoxville, Que., Can.
Rudolph, V. J.	Michigan State Univ.	East Lansing, Mich.
Ruuth, H.	Producer	Dorland, Ont., Can.
Ruuth, H. (Mrs.)	Producer	Dorland, Ont., Can.
Sapp, A. H.	Cary Maple Sugar Co., Inc.	Upper Darby, Pa.
Sears, S.	Catskill Maple Products Co.	Grand Gorge, N.Y.
Shepherd, A. L.	Virginia Polytechnic Inst.	Monterey, Va.
Sills, M.	Economic Research Service, USDA	Phila., Pa.
Sipple, L. H.	J. L. Sipple and Son	Bainbridge, N.Y.
Skog, R. E.	Michigan State Univ.	Marquette, Mich.
Smaltz, E. A.	General Foods Corp.	Evart, Mich.
Smatlak, S. J.	Penick and Ford Ltd.	Hoboken, N.J.
Smith, C. E.	Producer	South Bend, Ind.
Smith, C. E. (Mrs.)	Producer	South Bend, Ind.
Smith, M. E.	Univ. of Minnesota	St. Paul, Minn.
Smith, X. K.	Maple Cream and Sugar	South Dayton, N.Y.
Snow, A. G., Jr.	Forest Service, USDA	Burlington, Vt.
Spade, R. I.	Spade Farm	Ferrisburg, Vt.
Spade, R. I. (Mrs.)	Spade Farm	Ferrisburg, Vt.
Staats, L. T.	Cornell Univ.	Lake Placid, N.Y.
Steele, W. E.	Ontario Dept. of Lands and Forests	Downsview, Ont., Can.
Stevenson, C. A.	Curtice-Burns, Inc.	Rochester, N.Y.
Stransky, P.	Lamb and Lightning	Collingwood, Ont., Can.
Sullivan, J. W.	The Quaker Oats Co.	Barrington, Ill.
Szymujko, J. A.	Univ. of New Hampshire	Claremont, N.H.
Taylor, H.	Producer	Chagrin Falls, Ohio
Taylor, R. D.	Pennsylvania State Univ.	University Park, Pa.
Treadway, R. H.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Tschorn, D. A.	Producer	Cumberland, R.I.
Tschorn, R. E.	Northern Westchester Medical Group	Katonah, N.Y.
Underwood, J. C.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Vaillancourt, J. O.	Les Producteurs de Sucre d'Erable de Que.	Levis, Que., Can.
Vignola, A. P.	Empire Can Corp.	Brooklyn, N.Y.
Virkler, L.	Producer	Croghan, N.Y.

Name	Organization	Address
Wable, W. H.	Somerset County Maple Producers	Fort Hill, Pa.
Wable, W. H. (Mrs.)	Somerset County Maple Producers	Fort Hill, Pa.
Walters, B. F.	Producer	Somerset, Pa.
Watson, R. J.	Macdonald College	Prov. of Quebec, Can.
Webster, G.	WFIL AM-TV	Phila., Pa.
Wells, P. A.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Widrick, N.	Producer	Croghan, N. Y.
Willits, C. O.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Winch, F. E., Jr.	Cornell Univ.	Ithaca, N. Y.
Winch, F. E. (Mrs.)		Newfield, N. Y.
Woodward, C. F.	Eastern Util. Res. and Dev. Div.	Phila., Pa.
Wright, L.	New York Maple Producers Assoc.	Franklinville, N. Y.
York, S. W.	Producer	Eau Claire, Wis.
Yuke, G.	Madawaska Valley Maple Products Assoc.	Palmer Rapids, Ont., Can.

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